Automotive Service Digest

Our 46th year

May, 1958

Ready for the Open Road—See Page 14.

Since 1903...

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IN PROGRESS
to the
AUTOMOTIVE
INDUSTRY

PLYMOUTH—one of the leading engine manufacturers using Perfect Circle piston rings for original equipment.

Behind the world-wide acceptance of Perfect Circle is a history of more than half a century of PC engineering leadership—and more. There's a history, too, of unceasing creative research... a constant search for the new and the better... matchless manufacturing skills...and scores of contributions to the forward march of the automotive industry, year after year.

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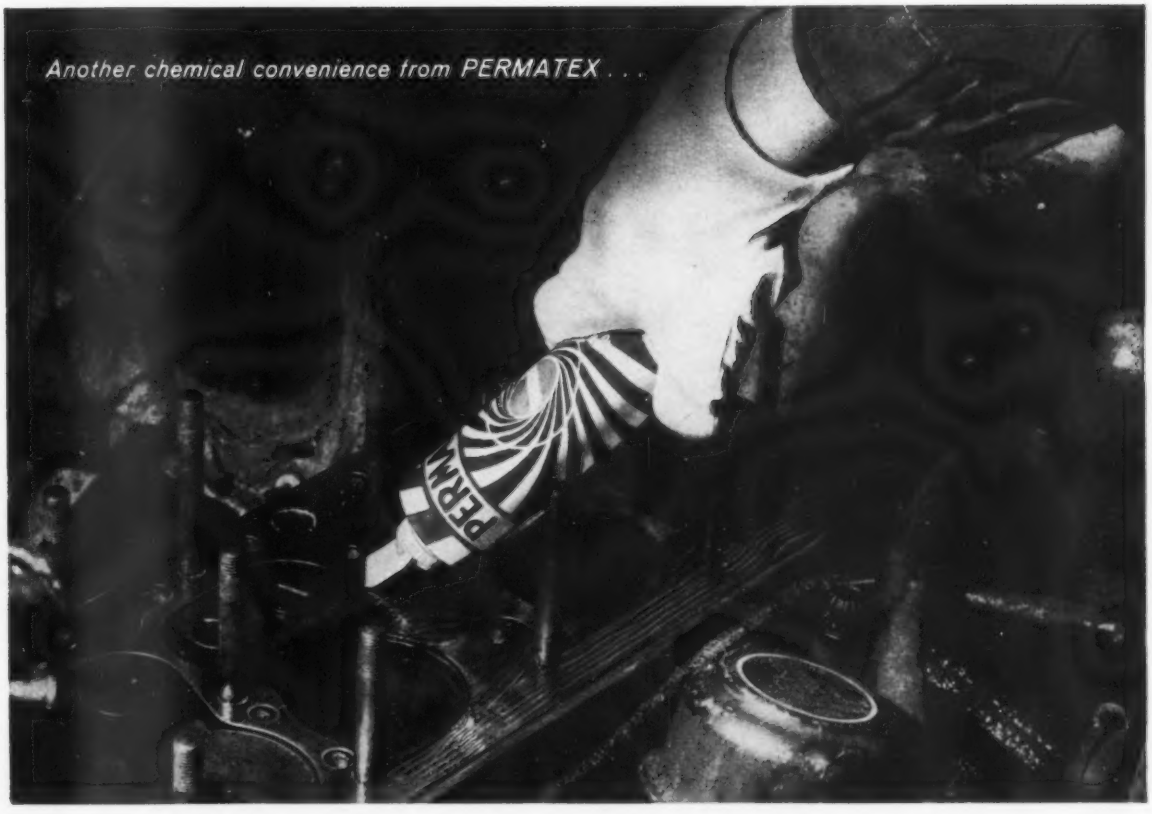

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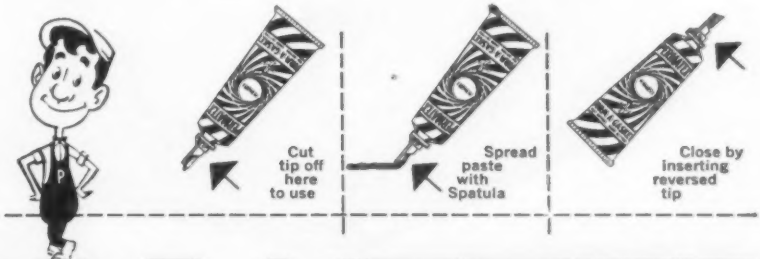

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ANOTHER **BLUE STREAK** SECRET SERVICE TIP FOR YOU

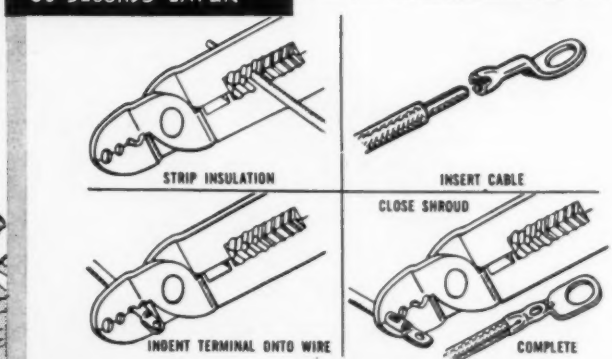
SHERLOCK McKANICK and MIKE

"...the CASE of the HOT FINGERS"

MIKE! OUR ENGAGEMENT'S OFF! I'VE NEVER HEARD SUCH LANGUAGE!
GOSH, SALLY, I'M SORRY! YOU WALKED IN JUST AS I BURNED MY FINGER WITH THAT BLANKETY-BLANK SOLDERING IRON!

SALLY, YOUR ENGAGEMENT IS ON AGAIN. THESE "STANDARD" SOLDERLESS TERMINALS SHOULD IMPROVE MIKE'S LANGUAGE — AND HIS TERMINAL CONNECTIONS — IMMEASURABLY.
GOLLY, SHERLOCK, HOW DO THEY WORK?

60 SECONDS LATER



"HERE'S A PERFECT CONNECTION — WIRE STRIPPED, TERMINAL APPLIED AND CRIMPED IN JUST ONE MINUTE. THE TERMINAL CONNECTION IS STRONGER THAN THE WIRE ITSELF."

ALL "STANDARD" SOLDERLESS TERMINALS ARE THE SUPERIOR SEAMLESS ONE-PIECE "AIRCRAFT TYPE" FOUND BEST FOR AUTOMOTIVE USE. (PAT. #2371469)

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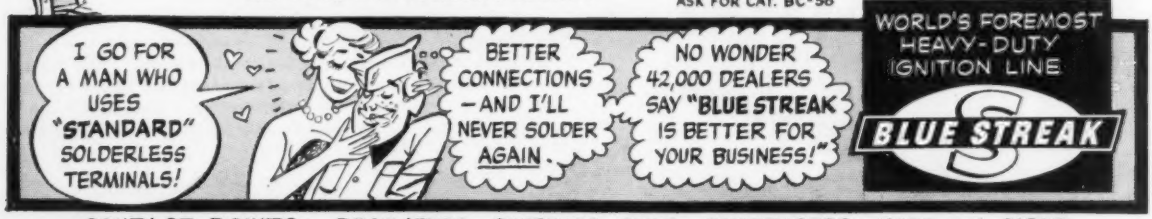
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BETTER CONNECTIONS — AND I'LL NEVER SOLDER AGAIN.
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BLUE STREAK

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VOLUME XXXXVI
No. 556

Automotive Service Digest

May 1958

Cover

Six velvet-smooth, asphalt-paved lanes stretching ahead, lure you to the open road on this section of the Massachusetts Turnpike. (Courtesy, The Asphalt Institute.)

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For June

● "College-Trained Mechanics," launching a new series devoted to Service Education. Timely — in a day when the automotive industry recognizes the increasingly acute shortage of skilled service personnel as one of its gravest problems — the articles in this series will be factual, informative, helpful to all those concerned with the upgrading of automotive servicing "across-the-board."

● Joining the long-proved "Tech know-how" and new "Business know-how" content, the Service Education series represents another major expansion in AUTOMOTIVE SERVICE DIGEST. While continuing, through the "Tech Know-how" material, to provide its readers with the most up-to-date and authentic technical information on step-by-step service procedures and on new developments, ASD will also include in its editorial coverage equally authentic and reliable articles on the fundamentals of successful business management, and on such related subjects as current programs and opportunities in meeting the skilled manpower challenge that faces all segments of the industry.

Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your shop letterhead and the information you are looking for will be promptly sent you.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 S. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Volkswagen Service

During the past year, several of my shop customers have become Volkswagen owners. Inasmuch as I want to keep their service business, I wonder if you can tell me where to get a good service manual on how to service these cars. Also, what is the story on replacement parts?—*F.W.G., St. Louis, Mo.*

Answer: Until recently, information on this car was not too readily available; perhaps due to the fact that the manufacturer feared that there would be service work of questionable quality performed on the vehicles.

However, a detailed, 144-page owner's manual is now available from Floyd Clymer, 1268 S. Alvarado St., Los Angeles 6, Calif. Price is $2.00, postpaid. While the book is called an "Owner's Handbook," it actually gives the necessary information for doing about any job except wreck work. It is well illustrated and includes all the necessary specifications.

Parts, in most cases, are available from the distributors of the cars, who will be found in most of the major cities throughout the U.S.

New Battery Is Old

A customer of mine has a four month old battery with a specific gravity of 1.225. The car starts okeh, and fan belt tension to the generator is correct. However, when the car is started, the battery charges for a few minutes and then cuts down to one or two amperes. Could this be a defective battery, or would you say the trouble is in the generator or regulator?—*R.W., Elgin, Ill.*

Answer: From your description, it sounds as if this battery may have been shelf sulphated when installed in your customer's car. If it was, it would take a higher voltage to charge, which would act just like the counter EMF of a well charged battery.

Any time a battery is found to have a specific gravity of less than 1.250 it should be removed and given a slow charge for 24 hours or more; or until the gravity will go no higher after four hours at constant gravity.

If there is more than 15 to 20 "points" of gravity (0.015-0.020) difference between any two cells, the battery is on its way to failure and will not last much longer. The quick discharge test (discharging through a carbon pile rheostat at three times [in amperes] the ampere-hour rating of the battery) for 15 seconds will give an idea of battery condition. The voltage per cell should not drop below 1.6 volts.

Flywheel Plate Cracks

Am having a flywheel problem on a 1957 Ford V-8 equipped with Fordomatic Drive.

This particular car has less than 3,000 miles on it, and within the past seven weeks, it has been necessary to install two flywheel plates. One, replaced by the local Ford dealer, lasted just about a month; the other, replaced in my shop, has cracked in the same manner as the first.

Both plates have broken and cracked across the ends where the bolt holes are located. Both times, there were no signs of vibration while driving or with the engine idling. All bolts and nuts were torqued to specified tightness.

This last time I found that installing large flat washers over the cracks and tightening the converter and flywheel plate together eliminated the clattering sound that occurs when the ends break off. This is just a temporary measure, of course, but within a short time the cracks reappear out beyond the washers toward the center, and cracks also appear across the face of the flywheel plate.

This sure has me stumped. Have you any suggestions?—*T.A.R., Ambler, Pa.*

Answer: From what you say, it looks as if there is definite misalignment somewhere in the assembly. There is also a good possibility that the wrong part may have been used, or that a change may have been made in the mounting. The Fordomatic Manual shows a round flywheel plate, while your sketch shows four corners on the plate, which leads us to question whether you were given the right part.

We would suggest that the flywheel plate (the right one) be accurately checked for flatness and run-out. Then before assembling, check the face against which the plate fits for flatness also. When assembling, use a torque wrench to be sure all bolts are tightened equally and to the specified torque. The shaft on which the plate fits should also be checked for run-out.

The part you mention will only break as described because of (1) excessive vibration, (2) distortion of either the part or its mating surface, (3) loose bolts, or (4) run-out of shaft or plate (excessive end-play).

Low Oil Pressure

It has been my experience that after 50 or 60 thousand miles, Studebaker V-8 engines develop low oil pressure, even though bearings, relief valve, etc. are okeh. To my way of thinking, it doesn't seem possible that cam bearings or lifters could be the cause, especially when all other parts are in good condition. What's the dope on this?—*H.T., Mankato, Minn.*

Answer: If oil pressure drops on a Studebaker V-8, or any other car—there is a reason for it. The reasons? Worn bearings, worn or defective oil pressure relief valve, dirty oil screen, leaks in the oil lines, or a worn oil pump.

After 50 thousand miles or more it is quite possible that the oil pump is worn to the extent that it will not build up and maintain normal pressure. The wear may appear at the ends of the gears, between the teeth, or at the ends of the recess in which the gears fit.

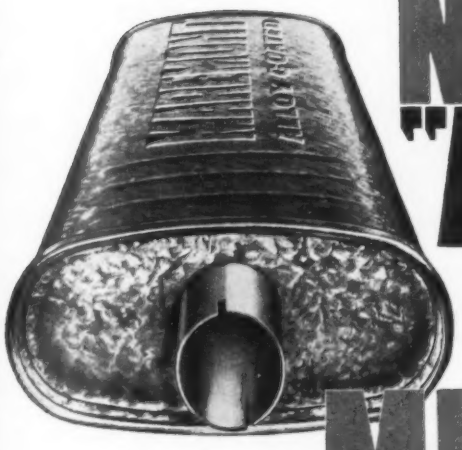
In some cases the pump can be made to develop its original pressure,

(Continued on page 8)

THE "ADDED-LIFE" MUFFLER LINE

MAREMONT

ACOUSTICALLY DESIGNED BY THE ELECTRONIC DYNAMOMETER*



NOW "ADDED LIFE" MUFFLERS

BY MAREMONT

ADVERTISED IN LIFE AND THE SATURDAY EVENING POST

TO MAKE YOU THE TOP MUFFLER INSTALLER IN YOUR AREA

Most popular Maremont mufflers now feature alloy-coated steel that fights corrosion to lengthen muffler life!

Exhaust acids produced by today's premium fuels are 50 TIMES AS STRONG (by standard pH acidity rating tests) as those of a few years ago. To meet this condition, Maremont has worked with one of the nation's great steel companies to procure a special aluminum-cadmium-lead-zinc alloy that inhibits corrosion. The result?—"Added-Life" mufflers, a development that makes ordinary mufflers out-of-date as hand cranks.

Sell the muffler that's acoustically engineered by the Electronic Dynamometer . . . sell the "Added-Life" muffler that delivers added value . . . sell Maremont!

*Pat. Pend.

Turn the page for proof of the "Added-Life" in Maremont Mufflers

Automotive Clinic . . .

(*Continued from page 6*)

or nearly so, by filing off the end of the housing and the end plate perfectly flat to take up the end on the gears. If the bearings or journals are worn, a new pump is needed.

The only way you can be certain the bearings are not passing too much oil is to test them with a leakage tester under pressure. They might be worn enough to lower the oil pressure, without causing a bearing knock.

Temp Gauge Always "Hot"

The heat indicator on a 1956 De Soto always registers "Hot," when actually the water temperature is only 165° when checked with a thermometer.

New sending and receiving units were installed, and a separate wire was installed from dash unit to sending unit in the block. What have I hooked up wrong?—*C.G., Florence, N.J.*

Answer: Your inquiry leads us to believe that possibly you got the wires crossed on the dash unit. There are two magnet circuits in the dash unit, one connected to the ignition switch and to ground; the other being connected to the ignition switch but grounded through the sending unit.

If you had the wires crossed, the unit would act somewhat like you describe, so try reversing wires on the dash unit. Also check the ground of the unit to the dash, and be sure the wire connecting the two units is tight at each end.

Engine "Rocks and Rolls"

A 1955 Plymouth Six was brought into our shop by a customer who complained of a "jumping and jerky" action whenever the throttle was opened; as well as very rough action on the road. I started the engine up, and it idled smoothly; vacuum reading was 20″. Spark plugs were removed and found to be slightly blackened, but were cleaned, regapped and put back in the engine —no improvement. A carburetor from the same make of car was put on, but did not improve engine action. I then removed the distributor and put it on my distributor test machine.

The points were in satisfactory condition and the automatic and vacuum advance were up to specifications. The distributor was put back on the engine, but there was no improvement. When the throttle was opened above idling speed, the engine would accelerate briefly, then "gasp" as if short of fuel, with violent surging as the speed alternately picked up and then quickly decelerated.

We feel that there should be an easy correction for this condition, but so far we have not been able to put our fingers on it. What would you suggest?—*B.J., Chicago, Ill.*

Answer: Inasmuch as you put the distributor on a distributorscope, we can assume that the dwell is satisfactory. An excessive dwell with very small point opening will sometimes act as you describe—much as though there is trouble in the fuel system.

Another possibility is the pigtail in the distributor. If the wire is broken at one of the terminals, with the end held in poor contact by the insulation, it could act as described. Still another possible cause could be resistor spark plugs in which one or more of the resistors has deteriorated, allowing a spark to jump at low high-tension voltage requirements and interrupting the spark when a throttle opened wider steps up the voltage required for sparking.

Our suggestion would be to check secondary efficiency with a high tension voltmeter, check for voltage drops in each part of the ignition circuit, check the flex-line in the fuel pump intake line and check fuel delivery (which should be at least a pint in 40 seconds). Also, it might be a good idea to test the coil, or in the absence of a coil tester, put on another coil for checking purposes.

Front End Wanders

One of our customer's 1952 Chrysler New Yorker has a bad tendency to wander on a rough road. On a smooth road it steers fine.

To overcome the trouble I have lined up the front end twice, balanced all wheels, installed new shocks all around and built-up the rear springs. Everything checks out perfectly, and a thorough inspection of the power steering unit does not disclose any defects there. Have you any suggestions?—*J.G.R., Tauton, Mass.*

"Here comes an aligning job, if I ever saw one!"

Answer: A tendency of the front end to wander is usually caused by insufficient caster. Increasing the caster about 1° should help. The factory specification is -1° to -3°, with -2° recommended. Therefore, if you cut it down to -1° or even 0°, it should help to correct the situation.

Be sure the front wheel bearings are properly adjusted and check the upper and lower control arms to be sure they are tight. Check all the ball joints in the steering system linkage and check the pitman arm for tightness on its shaft. Also be sure to check king pins and bushings for excessive wear.

Elusive Chatter

In a recent "Clinic" you had a letter from a reader having trouble with a "chatter" in a '57 V-8 Chevrolet at 16 m.p.h. in second and 24 m.p.h. in high.

We have a similar condition in a 1957 V-8 Chevrolet with standard transmission, except that this chatter comes in only at 24 m.p.h. in high on a pull.

The car has been tested while on jacks, but the noise does not come in under these conditions. Would appreciate any information you can give me on this condition.—*D.P., Brooklyn, N.Y.*

Answer: Any chatter or vibration comes from unbalance or loose parts; or a combination of both. Your problem is to find out the cause of the chatter.

If you cannot bring it in by running the engine unloaded, then your best bet will be to find a shop equipped with a dynamometer where you can run the engine under load. If this doesn't bring it in, it must be something connected with the chassis which is affected by driving on the road. If running the car on the dynamometer does bring in the chatter, use of a soundscope will help pinpoint the source or location.

In all probability the noise is coming from around the clutch or transmission; though it is possible it could come from the muffler or tailpipe vibrating harmonically at certain speeds. Since you do not give us an inkling as to the part of the car from which the chatter seems to be coming, we cannot give you much more information. You will just have to consider the possibilities and then localize the noise source.

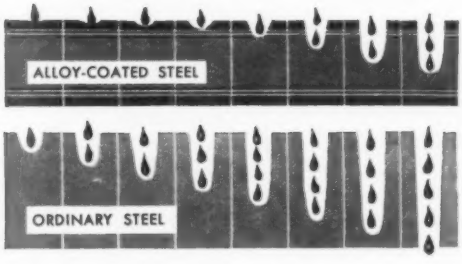
THE "ADDED-LIFE" MUFFLER LINE

MAREMONT

ACOUSTICALLY DESIGNED BY THE ELECTRONIC DYNAMOMETER*

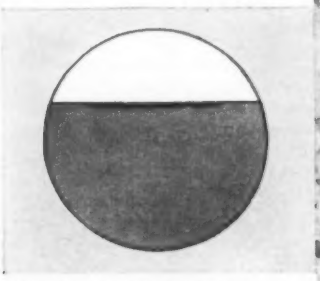
PROOF OF "ADDED LIFE"

MAREMONT ALLOY-COATED STEEL OUTLIVES UNCOATED STEEL TWICE AS THICK

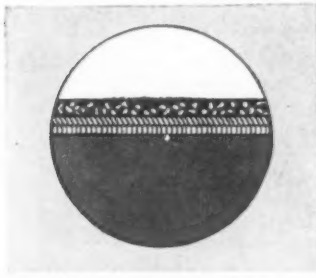


Actual road and laboratory tests indicate that today's powerful exhaust acids bite fast and deep into uncoated cold-rolled steel—no matter how thick. Corrosive action goes on day after day.

But Maremont's new Alloy-Coated mufflers neutralize exhaust acid and fight corrosion. The chart above shows that "Added-Life" steel outlives ordinary steel twice as thick. Since both sides of the steel are protected, each multi-wrap Maremont muffler provides FOUR corrosion barriers.



UNPROTECTED STEEL—in an accelerated 60-second test, becomes pitted and corroded almost immediately. Life of ordinary uncoated steel mufflers is drastically shortened.



MAREMONT ALLOY-COATED STEEL—in the same test, is virtually unaffected because the alloy of aluminum, cadmium, lead and zinc resists corrosion up to eleven times longer than uncoated steel.

ADVERTISED IN LIFE AND THE SATURDAY EVENING POST

SEE FOR YOURSELF . . .
IN JUST 60 SECONDS . . .
PROOF OF "ADDED LIFE"

One of the nation's leading corrosion research firms, Scientific Control Laboratories, Inc., Chicago, was retained by Maremont to determine the effects of exhaust condensate on the special new alloy-coated steel. Of the many tests developed by S.C.L. Inc., the accelerated wear test proved the superiority of the special alloy-coated steel over uncoated cold-rolled steel.

Your Maremont man can arrange your demonstration . . . no obligation of course. Ask him or write direct to Maremont Muffler Headquarters.

*Pat. Pend.

Turn the page for the industry's No. 1 merchandising program

Instrument corner

Conducted by The Instrument Man in the interests of simpler, faster, more satisfactory—and more profitable—service operations.

Failure to Test

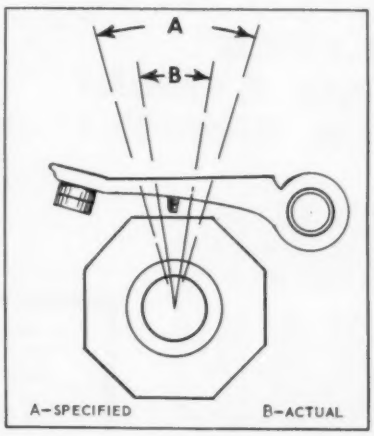
Ben had tuned the '55 Chevrolet V-8, which had been running pretty rough. He'd put in spark plugs, a set of breaker points, and a condenser. At 5:30, the engine was a bit rougher than when it came into the shop—and Ben had promised delivery at 6:00.

Beginning to get uneasy because of the hour and the fact that he was getting nowhere fast with the job, Ben called for help. As luck would have it, he caught up with The Instrument Man, who was in the neighborhood.

"What," asked The Instrument Man, "is the vacuum? What's the compression . . . the point resistance . . . the dwell . . . the secondary resistance?"

Always a man to tune by ear, rather than bother with instruments, Ben didn't know. He hadn't checked. But now, under stress and prodding, he dusted off the dwell meter and connected up to the distributor. What do you know—dwell read 16° and dwell variation, 11°, explaining the engine roughness! Correct dwell was 26-33° with maximum allowable variation of 3°.

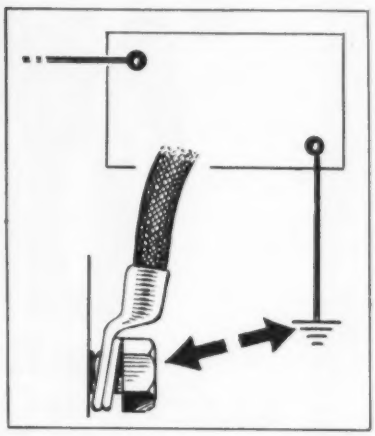
It was quitting time for The Instrument Man, now, and he left Ben—off to a good start at last on his trouble-some job—putting the distributor on a tester to see whether it was a worn cam or bad bearings that caused the excessive dwell variation. He ended up replacing the distributor just as the customer called for his car.



. . . And Bob, too, could have saved himself a lot of embarrassment, as well as a desperate call on The Instrument Man, in the case of the 1953 Olds that was hard to start, especially when hot.

After getting the car in his shop, Bob charged the battery, found that didn't help . . . so charged it some more, with no better results. Installing a new solenoid starter switch didn't improve performance of the starter system either. Nor did having the starter overhauled help; and having it rechecked by the overhaulers showed nothing wrong.

It was at this point, on the advice of The Instrument Man, that Bob used his voltmeter—and discovered a 1.5-volt drop in the battery ground circuit. When the battery ground strap running to the engine was removed, cleaned, replaced, and the terminals well tightened—the engine started up as good as the day it left the factory.



In addition to having to get help on the simplest of electrical problems, Bob had incurred the completely unnecessary expense of a new starter switch and a starter overhaul! And how could he charge out that kind of work? He was lucky that the customer had been allowed a "loaner" car, and wasn't around to see how simply the trouble was corrected . . . after testing.

Ballast Resistor Trouble

The owner of a 1956 Oldsmobile was pretty discouraged by the time he reached a service shop that practiced what it had been taught about instruments. He'd been experiencing hard starting, had taken the car to several shops where boys well regarded for their skill had tried, without success, to overcome the trouble. Unhappy at the prospect of continuing to have trouble every time he wanted to start the car, this customer was trying again.

This time he found a shop where the owner believed in testing and appreciated the value of instruments. A voltmeter was put across the battery to check cranking voltage as the first step. When that proved normal, the voltmeter was connected from the battery side of the coil to ground, and

(Continued on page 70)

WHY INSTRUMENT CORNER?

Because we know the help he's given so many shops first-hand is just as valuable in the re-telling as it was in the happening, we've asked The Instrument Man to pass along some of his more interesting experiences. As an old-timer in automotive servicing who is distinguished by the fact that he's kept up-to-the-minute on developments in his field, The Instrument Man gets many calls for help from friends, acquaintances and even strangers, in shops large and small. He generally solves the cases, because of his understanding and appreciation of trouble-shooting instruments.

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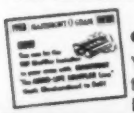

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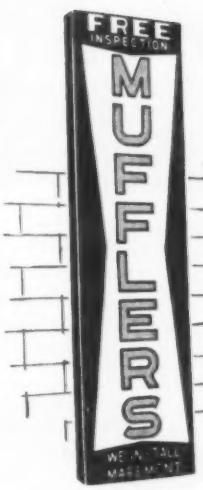

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Editor's page

The balance of power

● IN A SOCIETY OF STATES, balance of power is the principle of evenly matched political and military forces so inter-related that no single state, or group of allied states, can impose its will on the others. Without such political and military equilibrium, the unbalance of power spells trouble—ranging from simple irritation to blazing hostilities.

In the mechanical "society" of the modern automobile, equal importance attaches to the balance of power. All the rotating parts of the modern higher-compression, greater-horsepower and faster-turning engine must be balanced . . . or there's trouble ranging from simple owner vexation to breakdown and expensive repair. And the same requirement for original, and continued, balance of power applies to transmissions, propeller shafts, axles, wheels—the entire complex of parts and assemblies that rev up to modern automobile speeds.

Anyone who considers balance of power unimportant, or of little importance, should analyze the effects of the stress and vibration set up by a part dynamically out of balance. Consider, for example, the force unleashed by a 1 inch-ounce unbalance—which at 500 rpm exerts 7.3 ounces force, and at 2000 rpm, an amazing 7 lb.-5 oz! At 5000 rpm, that 1 inch-ounce unbalance becomes a force of 45 lb., acting to induce vibration, wear and metal fatigue!

Investigation indicates that perhaps too little attention is given to correctly balancing parts and assemblies in performing service work. The fact is, it must not be assumed that even new parts or assemblies from the factories are OK to install without first balancing them. Many an otherwise good tune-up is a "swindle" in the mind of the owner, who blames the shop that did the tune-up for the effect of such things as, for example, .090" run out in the propeller shaft assembly—which had never been given a thought.

Whenever the shopman has "tried everything," and the customer says, "It *still* shakes," it's high time to check for dynamic unbalance in a part or assembly; and to make corrections. It's possible too, for vibration from unbalance to exist and be absorbed by mountings. Detrimental effects from such a condition go unnoticed until premature wear destroys the part.

Balancing equipment is a "must" for shops rebuilding engines and other power units; and only its judicious use can be depended upon to restore the smooth, all-important balance of power in the modern automobile.

Ben Ikert
EDITOR

The case for tune-up

Detailed check-out of all the items that contribute to engine operation is behind the mechanics of a good tune-up. Modern instruments tell the whole story... to the service specialist and his sometimes reluctant customer.

By HERB CARRIER
Detroit Editor

• NEXT TO LUBRICATION and oil change, engine tune-up is the most commonly performed service given modern cars. Some manufacturers recommend a tune-up every 5,000 miles. With the average driver covering somewhere around 15,000 miles per year, and with close to 70 million vehicles on the road, it seems that all tune-up men must be busy 24 hours a day, seven days a week.

Unfortunately, such is not the case. What the manufacturer recommends, and what the owner does, are two different things. Some owners do get their cars tuned-up every 5,000 miles. Others resort to a tune-up only when their engine fails to start, or operates poorly.

Those of the latter school often reason something like this: "Sure, I know I should buy periodic tune-ups, but I've had a lot of expensive, unhappy experiences along that line. Several times, after being tuned my car ran worse than before. It got so I expected an average tune-up to require two or three trips back to the service shop to get the car running right.

"I gave up," one car owner says. "Now I just drive until something happens. Then I pull into a shop and say 'fix it.' I stand and wait, too. They don't sell me a tune-up anymore. I *know* what I'm buying."

Such arguments make some sense. Certainly, however, this customer is basically wrong... he's paying for tune-ups without getting them. There is a wide gap between poor performance and actual failure. However, in his own mind, he's following a sound maintenance program.

And he isn't alone. Many millions of car owners feel the same way about tune-ups. Apparently, the situation goes back to a feeling of distrust. Customers aren't sure what they are getting for their tune-up dollar. If their cars run comparatively well, but have enough miles on them that a tune-up is necessary, they hesitate to spend money for a mechanic to look it over and tune-it-up. They have to be "sold" on the need, the value and the cost.

MODERN EQUIPMENT

To the rescue of the mechanic who meets customer reluctance to tune-ups, comes modern analyzing equipment. Now it's possible to *show* the customer the condition of all parts and systems that influence engine operation.

Take oscilloscopes for example; they're very impressive. With one, you can actually *show* a customer poor ignition. Then you correct the trouble and—using the

Test stand check of distributor reveals much about its performance under different speeds and loads. Most such testers take distributors of any make; give accurate and easily-read results quickly.

Blowing out foreign material and carbon before removing plugs prevents engine damage, reduces chance of inaccurate compression readings. Loosen plugs two turns, then start engine. Run it 20 seconds.

oscilloscope—show him what you have done. This "show me" technique is an excellent way to demonstrate tune-up requirements and results.

Along the same line, other modern equipment now on the market does the job of convincing customers, while serving, also, as excellent tune-up tools.

PROCEDURE

The step-by-step procedure of a factory recommended tune-up hasn't changed much over the years. Typical is that of Chevrolet, which suggests the following "test-and-correct" items:

(1) Compression, (2) spark plugs, (3) distributor, (4) battery, (5) fan belt and generator, (6) manifolds, (7) fuel pumps, (8) carburetor, (9) cooling system.

Faithfully and carefully checking and, if necessary, correcting all these performance factors is bound to result in a satisfactory and back-to-standards tune-up. Skipping some, or assuming things are right without actually checking, are sure ways of opening the door to trouble.

Sequence, too, is important. Putting in new ignition contact points and condenser, or possibly overhauling a carburetor, is risky business unless compression is first checked. Also, checking compression on a cold engine is another way to wind up in left field.

A first class tune-up is roughly divided into two parts, mechanical operation, and electrical check-out. *Always* start with a thoroughly warmed up engine, and follow the recommended step-by-step procedure.

COMPRESSION

To check engine compression properly, remove the ignition cables and loosen each spark plug a couple of full turns. Replace the cables and run the engine for about 20 seconds. This step is **important.** Loosening the plugs causes flakes of carbon to drop off the threads. It's possible for this carbon to become temporarily wedged under a valve, resulting in an inaccurate compression reading. Another good reason for this preliminary step is to blow out any dirt or abrasive foreign matter which may be lodged in the spark plug wells; and thereby preventing its entering the cylinders.

CHECK HEAT RANGE

While the plugs are being removed, they should be individually inspected. Plugs that have heavy, black carbon deposits indicate that they have been running too cold. Blistered or glazed plugs indicate they have been running too hot. A quick check of the plug chart will reveal whether the plugs are of the proper heat range.

If the plugs used are in the normal heat range for the engine, and still they operate hot or cold, new plugs must be installed to compensate for individual driver habits. Always use new copper gaskets, and torque the plugs according to specifications.

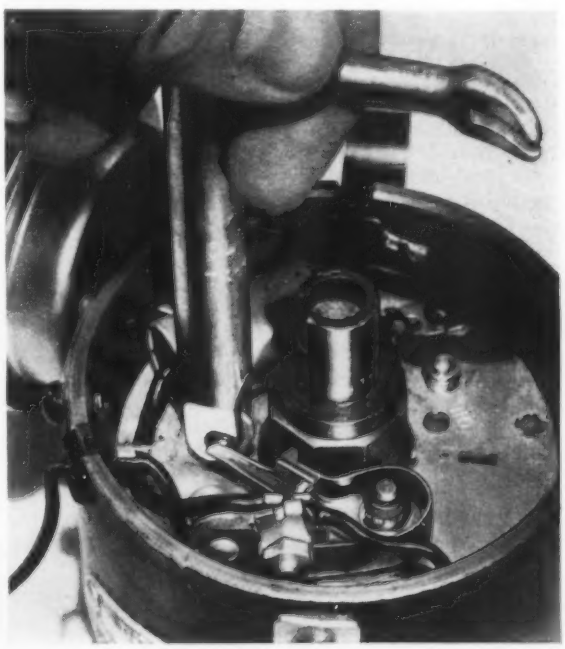
Finally, before taking a compression reading, remove the air cleaner, and block the throttle wide open. A plugged filter, or a closed throttle can influence compression.

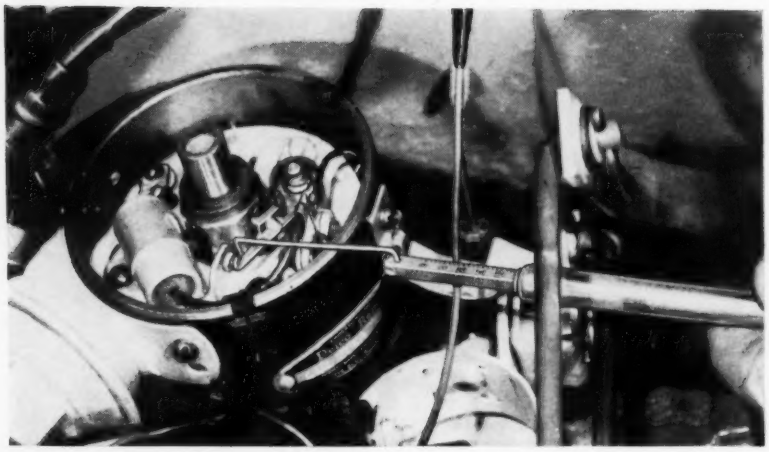
DIAGNOSING RESULTS

Much can be told by careful study of the compression readings. For example, all cylinders must be within 20 pounds of each other to insure smooth engine operation. If one cylinder is considerably below minimum, about a tablespoon of engine oil should be injected into the cylinder, and compression rechecked. If the compression comes up nearer to normal, it indicates rings and walls are worn. (The introduction of oil itself has some influence on raising the gauge reading, as compression ratio will be increased.) If compression does not come up, it indicates worn or sticky valves. Low compression on two adjacent cylinders indicates a blown head gasket between

(Continued on following page)

Only a special tool should be used when bending the stationary point to align ignition contact points. Never use pliers! Never align the movable point.





Contact point spring tension should be tested with scale applied at 90° to breaker arm. Too little tension will permit points to float, limit top speed; too much, result in rapid rubbing block wear.

The Case for Tune-Up . . . CONTINUED

the low reading cylinders. Available leakage testers will assist in pinpointing faulty compression. Always record compression readings as they are taken. Don't commit them to memory.

DISTRIBUTOR

Distributor check begins with a complete visual inspection. Look closely for frayed, oil soaked, or brittle cables. Inspect terminals for corrosion or cracks. Check the rubber support grommets. Replace all faulty or defective cables or grommets. Be sure secondary ignition cables are installed in proper grommet holes to prevent "crossover."

Remove the distributor cap. Inspect cap for hairline cracks or carbon tracks. Look at each terminal to see if the rotor has been striking. Also note condition of the carbon plug which extends from the center tower to the rotor button.

Check distributor plate. It should be free to rotate partially, in the direction which normally advances the spark. If distributor is equipped with lubrication fittings, add a few drops of engine oil. Wipe off any excess oil to prevent it from contaminating the contact points.

Remove the rotor, and check condition of points; (On some engines, it is easier to remove the distributor from the engine. When doing so, be sure to scribe the rotor position so that it can be installed in the same relative spot.) Breaker points in good condition are an even grey color, and have smooth contact surfaces. Points which are pitted, or burned, should be replaced.

Slightly pitted points are often reconditioned with a point file, although some outstanding experts do *not* recommend it. One of them points out:

"It is a very frequent and disturbing practice in the field to use files or stones on contacts to remove metal transfer. Since tungsten is extremely hard, it is unavoidable that some pieces of steel or other foreign particles will be left on the contact surfaces as a result of this 'dressing'. A vehicle owner who has 'dressed' his contacts, will, in a very short time, experience malfunctioning of his ignition system due to oxidation. This oxidation is of course a direct result of the fine pieces of steel or other foreign particles left on the contact surfaces as a result of the 'dressing' operation. It is for this reason, of course, that many people in the field believe that metal transfer is deleterious to ignition system performance. Actually, as you can see, the metal transfer in itself had nothing to do with the malfunction."

Judging from such comments, it may be best to replace ignition contact points, rather than file them.

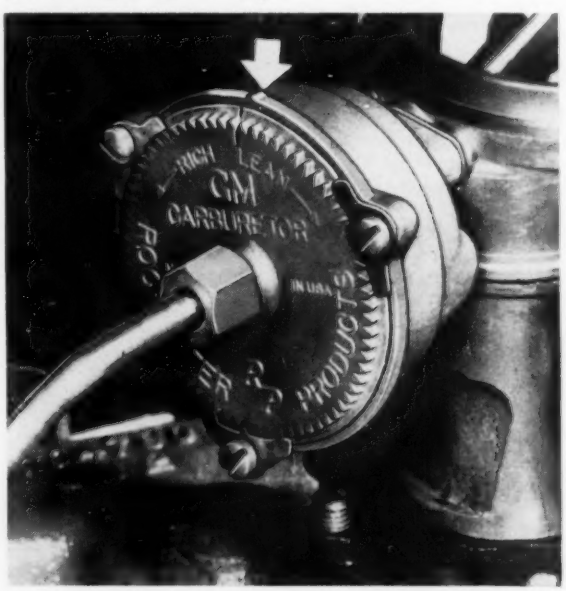
Now points must be properly installed and aligned so that the contact surfaces meet directly on center. Use an aligning tool, if necessary, and position the *stationary* point to obtain accurate alignment. *Never* align points with a pair of pliers, and *never* bend the movable point.

Adjust points to proper gap. Be sure feeler gauge is perfectly clean. When adjusting reconditioned points, set gap *right to specifications.* On new points, leave gap about .003" wide to allow for rubbing block wear-in. Spread a light film of vaseline or similar lubricant on the cam to prevent excessive wear of the rubbing block.

SPRING TENSION

With an ignition spring gauge, test point spring tension. Exert pull at 90 degrees to breaker arm. Read tension on scale just as points separate. If necessary, adjust tension to specifications. Some points provide an adjustment slot. On others the spring must be pinched or spread apart for adjustment. High spring tension may cause

Line-up scribe mark on cover plate of automatic choke with raised indicator on housing. Variation from this setting can cause poor starting, idling or mileage.



rapid point wear, while low tension may limit top engine speed because the points "float" or bounce.

With points properly installed, install the rotor and distributor cap. Press the spark plug cables and coil-to-distributor cable firmly into cap towers, to minimize chance of corrosion in the sockets.

BATTERY

Check level of battery electrolyte. If necessary, add distilled water. Clean battery top thoroughly. If excessive corrosion is present around the terminals, brush on a solution of baking soda and water; flush with clear water, and dry with compressed air. Inspect the battery closely for cracks, or other defects. Spread a light film of vaseline over terminals, and snug up battery hold down bolts. Over tightening here can cause the battery case to crack. Be sure cable terminals are clean and bright both inside and out.

Check fan belt. Adjust if necessary. Inspect generator for loose or frayed wires. Also note condition of brushes. Inspect the manifold heat riser for proper operation. Correct as necessary. (See AUTOMOTIVE SERVICE DIGEST, March 1958, page 14, for detailed heat riser information.)

Torque intake manifold bolts to specifications. Tighten carburetor mounting nuts. If carburetor is equipped with an automatic choke, be sure the scribe mark and cast indicator on choke housing assembly are in alignment. Also, check unloader adjustment, and correct as necessary. Test the throttle linkage adjustment to be certain throttle plate is wide open when accelerator pedal is fully depressed. An improper adjustment here is the source of many high speed complaints.

Check the entire cooling system for leaks or defective hose. Pressure testers are available to check cooling system under actual operating pressure. The old, simple "finger test" of the radiator neck and coolant, is still a reliable detector of internal rusting . . . requiring corrective service.

START ENGINE

At this point, start engine and allow to idle. While engine is warming up, clean the air filter and the crankcase breather cap. Also give the car a safety check for brake adjustment, clutch pedal adjustment (if used), turn indicator operation, windshield wiper condition and operation, and lights and horns. Record any item which needs attention, so that the customer may be informed. When engine is at normal operating temperature, torque cylinder head bolts to specifications. Start torquing at the middle of head and work alternately to either end. This is to prevent the possibility of head buckling or warping.

Next, a complete electrical check-out with an analyzer is in order. With suitable equipment, such a check can be made in a matter of minutes. The results will reveal whether all mechanical operations were properly performed, and will also point out areas which may require additional service which is not covered in the tune-up job.

Another benefit can be gained from such a test if it is conducted in the presence of the customer—He'll be favorably impressed and completely "sold" if he stands by and watches his engine—and your work—check out to snuff.

Tune-up equipment varies in design and operation. In general, however, any quality tester checks out the cranking circuit, voltage regulator, primary and secondary ignition resistance, ignition output, engine RPM, cam dwell, dwell variation, engine vacuum, fuel pump vacuum and pressure, and ignition timing. Most analyzers have a self-contained timing light with a flash retarder to permit on-vehicle testing of distributor advance mechanisms.

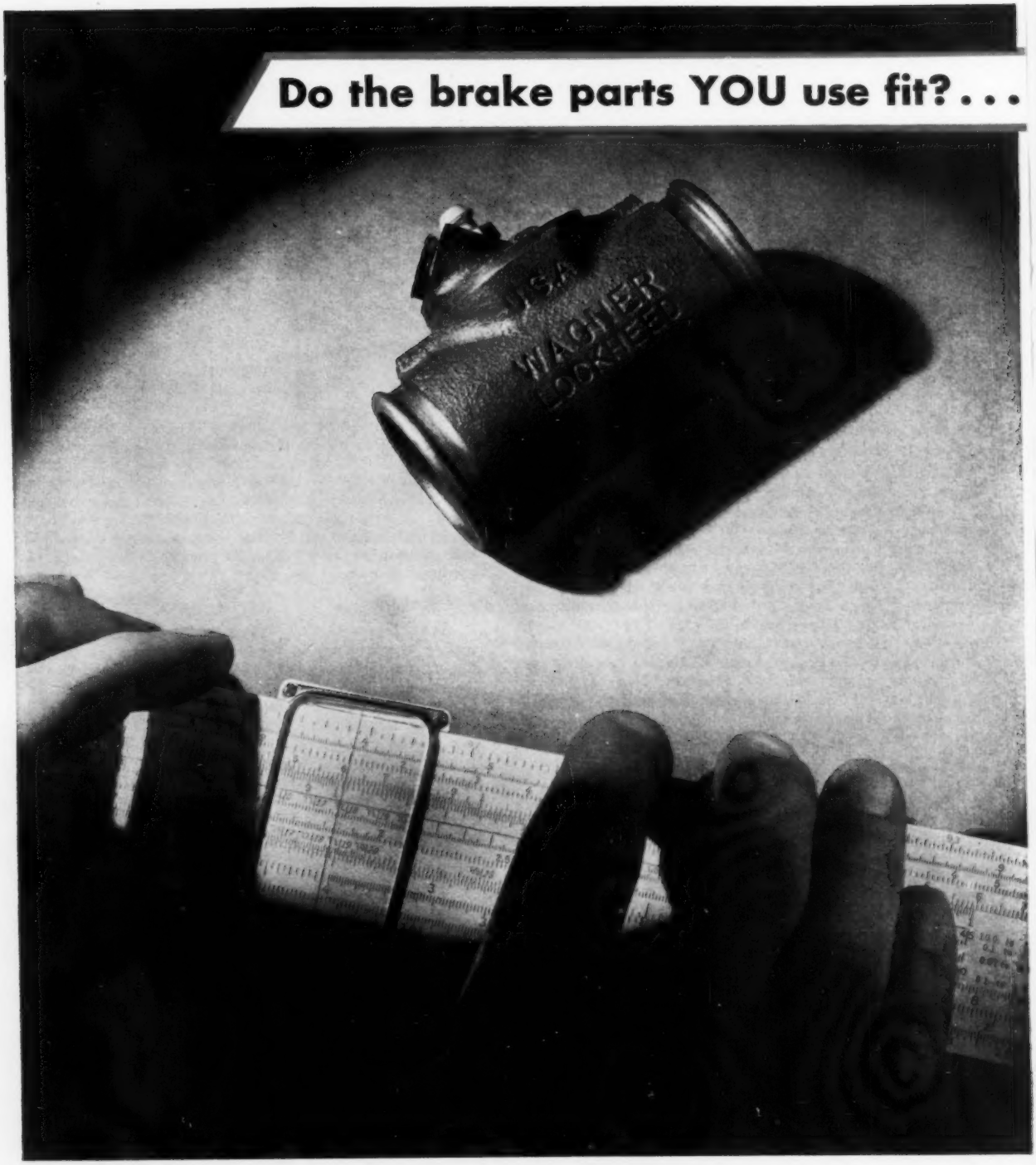
Methods of using such equipment vary somewhat, but all are uncomplicated and easy. Different makes of cars require different hook ups. For example, care must be exercised not to connect equipment in opposite polarity. If a car is positive ground, the equipment must be connected accordingly. Remember, however, that with all modern passenger car ignition systems, the secondary or high-tension ignition circuit is negatively grounded regardless of battery polarity.

FOLLOW SEQUENCE

As in the mechanical section of a tune-up, logical procedure is important in the electrical check-out section. Expert planning of operation technique goes into the engineering development of modern tune-up equipment. It's best to follow the recommended sequence. It's usually the most dependable and fastest way to complete the test. If the customer is present, he will appreciate an orderly procedure. He may not be a mechanic, but he'll know if you double back over the same operation several times. Then too, it's usually as easy to develop the habit of doing it the right way as to "experiment." Knowing you are doing the check properly and in the correct sequence will give you added confidence in your equipment and in your own ability.

Sometimes the use of such equipment can be effective in showing the customer who only wants a "miss" corrected that he needs a tune-up. A quick check out of all performance factors quite likely will reveal several areas that are contributing directly to the misfiring, or to overall poor performance.

Volume delivered by the fuel pump is very important —good pressure but low volume can result in poor high speed performance. Measure volume against car spec. Run engine no longer than is necessary.



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Improvements in both engine and piston ring design have changed the servicing picture. There's lots to be learned—from old-timers and newcomers alike—about

Why ring jobs come back

● **THE EVOLUTION** of piston ring design and precision techniques for their fitting, has closely paralleled the improvement in our automotive power plant's efficiency down through the years. So much of this history lies within the confines of one working lifetime that many old timers on the service line can relate some interesting and painful experiences of working with the most primitive tools and methods for installing piston rings at the beginning of their careers in the trade.

Problems of the past can help enlighten modern mechanics on the basis and importance of recommended procedures of the present, as many of them were mothered by necessity. For job failures, research and experimentation, flow on and on like Old Man River. When the old timer sounds off on the rigorous, early-day methods of reboring cylinders, when he and his buddy sat on opposite sides of the block and passed a reamer handle back and forth for a half-day's backbreaking labor and then began laboriously lapping them smooth with a grooved piston covered with abrasive, the youngster may listen and marvel. But he by no means need hold his peace, for he may well have experienced ring trouble in new vehicles still in warranty, or in replacement ring jobs he did himself. The old timers can also learn from his experiences.

WORN RINGS MEANT NEW PISTONS

There were times when successfully installing replacement rings on the original piston after the original rings were worn out, was of such a problematical nature that most mechanics wouldn't risk it. Be the mileage 5,000, 10,000, 15,000 or 20,000, they rebored and installed oversize pistons with the new rings and no argument.

The rings of that day were cut to size, were inflexible so far as following cylinder irregularities was concerned and so naturally, could not be made to seal-off pressure or oil; for wide gaps occurred between ring and worn cylinder wall at many points during piston travel. The rings were supported rather rigidly in the piston grooves, so any rocking of a worn piston tipped them so their bearing surface lost contact further with the wall.

Since the cause for leakage past these rigid rings was so obvious, it wasn't long before several designers came along with steel ring arrangements that held a snug contact with irregular walls—come hell or high water. One type, in fact, sealed so well where others couldn't seal at all, that they quickly gained favor and were in wide use among mechanics before their just-as-obvious weakness became apparent. True enough, they dried up the worst oil burners; but they did it *so* effectively that the upper rings could get no lubrication at all, and the wall pressure was so great that cylinder walls were quickly worn to some fantastic oversize. They proved

By E. S. HARRIS
Field Editor

There was a time when no mechanic would risk installing new rings on the original piston. Regardless of mileage, the going rule was, "Re-bore and install oversize pistons and rings."

to be simply too much of a good thing and soon faded from the picture.

PRECISION UNITS WITH COMPLEX DUTIES

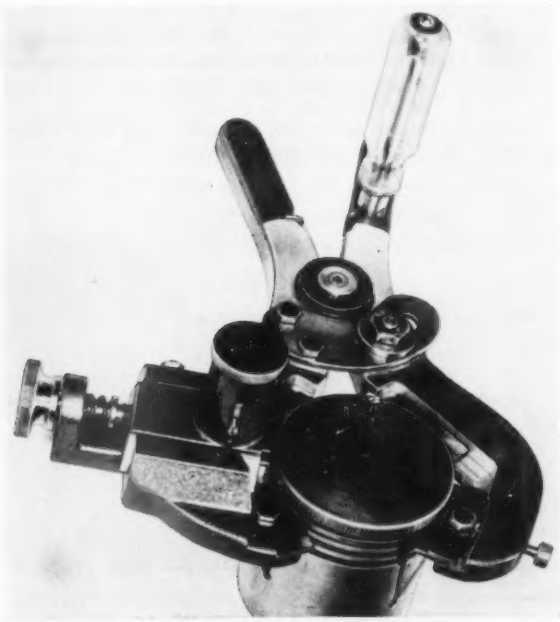
But from them another lesson was learned by both mechanics and ring designers. Piston rings weren't simply a "packing" between cylinder wall and piston, they were precision units with complex duties; and these duties were rapidly increasing in complexity with each hike in compression and rpm built into engines of new design. The same rings, too, might not be applicable to every sealing situation. Certain surfaces, individual operation problems, and particular engine designs, might call for different type rings. If rings are to perform their duties of maintaining a gas and vacuum-tight seal between piston and wall, while helping dissipate piston heat; and are then to meter lubricant over many surfaces to provide a hydraulic seal and a lubricant film for moving parts—without sacrificing too much of the lubricant to the firing chamber—they definitely require expert design, careful choice, and special installation care to do the job.

Engine improvements during the last 10 years have magnified piston ring application problems that previously were only suspected. The brake horsepower in our modern high-output engines has more than doubled. Compression ratio has risen from 6.7 average to 9.0 and up. Engine rpm ratings have been raised 25% or more. (Piston speeds have not increased at the same percentage due to the trend to bigger bores and shorter strokes; but are up possibly 10%.) In other words the piston rings must seal greater compression and firing pressures on compression and power strokes to avoid blow-by into the crankcase; and then seal the higher vacuum on the intake stroke to avoid oil escape into the firing chamber, while moving at a higher average speed than ever before.

A REAL ACCOMPLISHMENT

Rings are then working between pressures in both directions which not only requires complete cylinder wall contact but tight side sealing of the ring in the piston at both top and bottom, and during all strokes of the piston.

Modern shop practice requires regrooving the piston whenever necessary to insure satisfactory ring seating and tolerances.



Rolling the ring in the groove to check clearance is a quick and accurate trade trick of today's service specialist.

While a sealing job of that magnitude under present conditions is a real accomplishment for rings on a new piston in a new and true bore, it would seem that a re-ring job on the old pistons and with a worn cylinder would be almost too much to expect reasonably. In fact, it would appear that a flashback to the mechanics who wouldn't attempt a re-ring job might be in order.

But the fact is that the ring designers were not idle in the re-ring department while developing the original ring equipment. Following the etiquette procedure for a fashionable marriage ceremony where the bride wears "something old and something new, something borrowed and something blue," the designers made use of atomic tracer testing procedures; while chrome, cast iron and steel were used to devise ring assemblies for all occasions and situations. Side sealing was sometimes obtained by ingenious leverage application; low wall pressure and reasonable lubrication control were always a consideration, while pressure sealing was the goal.

TEST RESULTS MEAN LITTLE TO CAR OWNER

The success of their ring assemblies to this point was in their own hands. They could prepare the cylinders in their test engines, fit the pistons and rings, guard against superfluous oil from worn bearings and choose the type of lubricant after assembling the job. What happened to these same ring sets when shipped to the many parts wholesale outlets was now the question. For the behavior of piston rings in test engines at distant test grounds means little to the mechanic who installs the rings in the field, or the customer who buys the job from him. They are concerned only with the behavior of the rings in *their* car.

There are a lot of things that the mechanic can do to assure a good ring job, whether he is the old timer on the line or the newcomer. Some of the time-honored bench operations are done the same as before—only they may have to be executed more carefully and to closer limits. Others may have been outmoded—and should be abandoned—while still other steps may be completely new and done according to the dictates of the particular ring set involved. *(Continued on following page)*

Proper ring installing tools like this are available in modern shops, and should always be used. Twisting and jamming by hand causes distortion, one leading cause of piston ring failure.

Why Ring Jobs Come Back . . . CONTINUED

It's expensive to learn by mistakes; experience is possibly still the best teacher but, as ever, is mighty slow and dear. Profiting by others' mistakes however, can shorten the term of learning and cut the cost considerably. For that reason let's look into some of the boners that resulted in comebacks and at rumors of comebacks that reached the designers' ears, so we can avoid them by being forewarned.

First and foremost, many mechanics haven't yet overcome one of the bad habits more common to the breed than any other—they simply don't "read the directions". Some claim that it is the mechanic's puzzle-peg mind that wants to see if he can't reason out the way to do it without the help of the small print; while others claim that while reading directions, they are wasting time they should be using to spin nuts. It's well to remember in any case that different types of piston rings were dreamed up by different engineering crews; and they didn't all necessarily arrive at the same procedure for the installation. As for wasting time, you can read a lot of instructions with a lot less effort than pulling down any engine for a comeback. Many a factory ring complaint from the mechanic would have been avoided if the rings had been put on the piston as directed.

Failure of new rings to do an acceptable job of sealing then, may all too often be traced to improper procedure in installing them. When rechecking after a comeback, they are found to be distorted so they can't make good wall or groove-side contact, thereby failing to seal. The reason for the distortion is usually obvious, and easily remedied by simply making use of a ring installing tool. If an installing tool is not available for the job and the rings must be placed on the piston by hand, then use care in spreading them and sliding them carefully down the piston to the proper groove. Distortion is usually caused by twisting the ring to install one end in its groove and then forcing the rest of the ring around the piston until it is jammed into place, thereby distorting it permanently so it can't function.

RING FIT ONLY HALF THE STORY

The same mechanic who wouldn't think of installing a bearing insert without making certain of its seat in the bore, will often forget that a ring's seat in the groove is equally vital. Like the bearing's fit on the journal, the ring's fit on the cylinder wall is of course, the first consideration; but that is only half of the story. If rings are not properly supported by an equally good fit in the bore or groove, they cannot do their job.

Groove wear should be just as important a measurement as cylinder bore size when installing rings—the likelihood of wear is as certain in one as the other, and the necessity for ring contact at side and face is equal. The tolerance for groove wear varies in various engines and pistons but it should be complied with when fitting rings. Regroove the piston when wear measurements indicate it, otherwise sealing is hopeless. Typical practice. if a .006" feeler will pass between ring and top groove—re-groove.

Mechanics who don't know "what end is up" can logically and honestly claim the rings they installed are making an oil burner. Rings designed to scrape oil downward to the crankcase when installed right-side-up, will, of course, scrape the oil upwards to the firing chamber if installed upside down. Rings admittedly don't know which end is up; but the directions give the tip, and the mechanic makes the choice.

RING GROOVE DEPTH MAY VARY

While you don't often hear of a comeback due to thick rings being installed in shallow grooves, that doesn't mean that some mechanics haven't lost considerable time removing all the rings in the set after they installed them and then tried to put them back in the cylinders—only to find they wouldn't enter. Other combinations might result in a comeback after the engine was reassembled and put in service, so to avoid wasted time in either category it is well to remember that all piston ring grooves are not to the SAE depth standard. Usually you can find ring sets with thicker or thinner walls to match the groove depth in such pistons. Don't forget to clean the carbon out of the grooves before measuring them for depths—believe it or not—some mechanics have! If the ring protrudes beyond the piston land after it is pushed to the bottom of its groove—measure again. It should either be flush with the land surface or slightly below, depending on the type of ring but never protrude above the land.

Whereas mechanics may prove that they know straight up and install their rings properly on the piston, some come a cropper by being too trusting. When a piston is pulled to examine recently installed rings for poor sealing, and they are found to be broken or distorted—sometimes with a section or so of the broken ring welded into its groove—the expert usually shakes his head and comments that the mechanic who installed them wasn't cynical enough. He either didn't measure all the cylinders

(Continued on page 78)

One mark of the thorough service specialist; the final feeler gauge check of ring clearance—a vital factor in performance.

25 million tune-ups a year!

GET YOUR SHARE WITH THIS Snap-on® TUNE-UP SET

MT-318-B Tune-up Set

Available on easy payments.

Set contains compression gauge with adaptor, vacuum gauge with nine adaptors, timing light with adaptors, cylinder pressure adaptor.

Each tool is a dependable, precision instrument. Gauges are designed with bushed bearings and ultra-accurate spring movement. Complete set comes in handsome, husky metal case.

INDUSTRY sources report over 25 million tune-ups last year — and going up! If you're not cashing in, start now the right way — with this modern, accurate MT-318-B set. If you're using old, worn-out equipment, start fresh with *Snap-on* and give your customers the best tune-up ever. Either way, *Snap-on* will help you own this profit-boosting equipment on easy payments.

With the MT-318-B set, any mechanic can quickly spot most engine faults — can shorten tune-up time and turn out easy-starting, sweet-running jobs. That's what gets the word around — brings in the new business.

Get on the tune-up money wagon — right now. Equip your shop or service station with the complete *Snap-on* tool and equipment setup you need for better profits. Do it the easy way — with a little down, a little each week. Ask your *Snap-on* man for the facts.

SNAP-ON TOOLS
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8018-E 28th Avenue Kenosha, Wisconsin

The service side of a "selling ride"

Certainly the car owner expects gradual loss of that boulevard ride he bought built-into the car when new. But . . . does he understand the hazard as well as the inconveniences of neglected shocks? He should be told.

• RIDING COMFORT is recognized throughout the industry as a major factor in selling new cars. When one of the "big" men in the replacement market field made that statement at a recent meeting, it occasioned no surprise. More impressive were his comments about the golden opportunity for building business in the automotive aftermarket on the basis of the same "sellable" riding comfort. While cars a year or two old are still comparatively new, the boulevard ride they are delivering after 25,000 to 30,000 miles of wear is not the same ride that helped sell them.

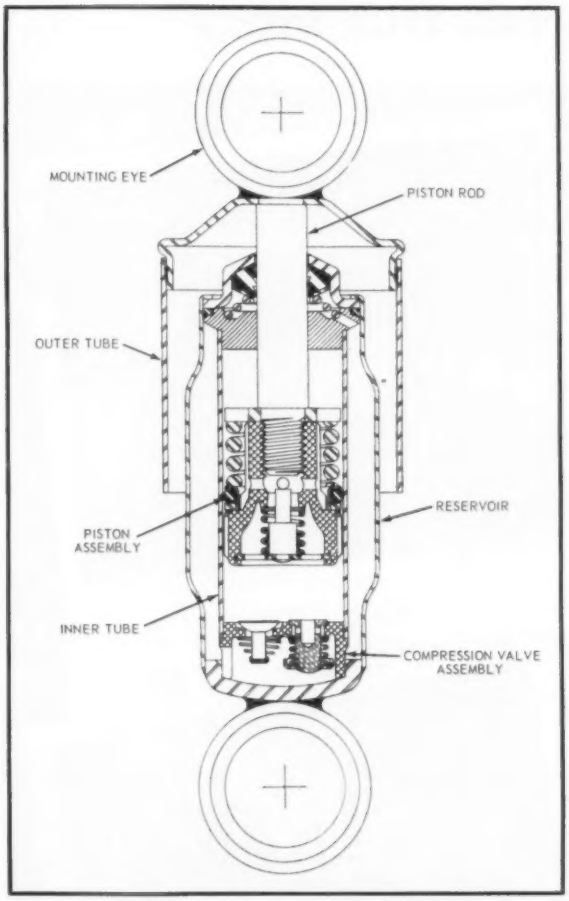
RIDE CAN BE RESTORED

This is where we come in. Much of the original ride can be restored quickly and inexpensively by replacing one of the most important elements of ride control—the shock absorbers.

Shock absorbers have been an integral part of automobile suspension for almost as many years as cars have been built. Through the years, various designs have been used, but in the last ten or more years the telescopic type (airplane shock) has dominated the field. It appears to provide the best all-around means of controlling car suspension so as to secure a comfortable ride. But there's more to the shock absorber story than the function of ironing out bumps for the sake of riding comfort.

"Shocks" play an active part in vehicle safety, and in extending the life of costly components. Pointing up these seldom voiced qualities is an effective way of increasing shock absorber business. According to Mr. Ralph Whisler, Chief Engineer of the Gabriel Co. and one of the ranking experts in the shock absorber field, car owners should be told about the stability, road-hugging and general vehicle handling characteristics which prop-

By HERB CARRIER
Detroit Editor



erly functioning shock absorbers contribute.

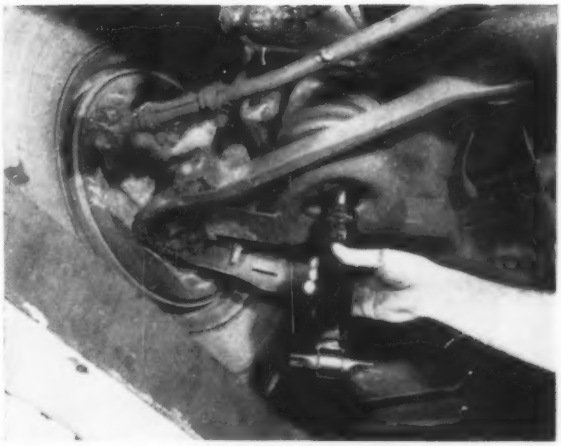
"It's not telling the whole story," Mr. Whisler says, "to sell shock absorbers on the 'boulevard ride' angle alone. Many owners accept decreased riding comfort as their cars get older. But if they knew the other by-products of having defective shocks, they would readily understand the importance of replacing those which aren't doing the job."

CONSTRUCTION OF THE SHOCK ABSORBER

A conventional hydraulic direct-acting shock absorber is little more than a piston which operates in a fluid filled cylinder. The cylinder itself is attached to the suspension unit, and rises and falls as the spring compresses and rebounds. The piston is attached to a long-stem piston rod secured to the car frame or underbody; and divides the cylinder into an upper and a lower chamber.

As the spring is compressed, the piston is forced downward in the fluid filled cylinder. Because the fluid is virtually incompressible, there must be provisions for its displacement, in order to get any movement of the piston. For this purpose, valve assemblies which permit fluid to pass from the lower chamber through the piston, into the upper chamber at controlled pressures, are built into the piston. However, the upper chamber cannot hold all the fluid the piston displaces, because the piston rod, located in the upper chamber, takes up part of the volume.

Therefore, the shock absorber includes an outer cylinder, called a reservoir, which acts as a receptacle for fluid. All fluid entering or leaving the reservoir must pass through a compression valve assembly located at the



Left: cross-section of standard shock. Above: front shocks are usually mounted, between frame and lower control arm, so as to pass completely through coil spring. Removal and installation can be done without disturbing spring, control arm, other units.

bottom of the cylinder. The amount of fluid passing through the compression valve is directly proportional to length of piston stroke.

On rebound, the operation is reversed. This piston is pulled up and fluid is returned to the lower chamber through the rebound valves in the piston and the replenishing valve in the compression valve assembly.

In operation, this compression rebound cycle is repeated hundreds of times per mile.

DAMPING EFFECT

The purpose of having the shock absorber behave this way is primarily to reduce the amplitude of motion the spring goes through.

This action can be explained by picturing a heavy iron weight suspended at the end of a rope. To get the weight swinging freely in a wide arc requires only a gentle push at the right time. A child can easily do so by slowly increasing—or amplifying—the motion at the right moment.

This is the same kind of thing that would happen to a modern car if it did not have shock absorbers. A bump would start the car bouncing, then additional bumps would amplify the bounce to jackrabbit proportions.

A well functioning shock absorber dampens the action, but does not influence spring rate.* The result is that the springs are allowed to absorb road shocks without building up excessive bounce. A well-designed suspension system can negotiate extremely rough roads without causing the vehicle sprung weight* to suffer unusual pitch* or roll*. It is this "riding quality" that people associate with shock absorbers.

OTHER FUNCTIONS OF "SHOCKS"

But, going back to the comments about road-hugging, stability, and handling, these are the little-publicized contributions of shock absorbers:

Road Hugging is a very vital asset. Tires must be kept on the ground at all times. Weak or worn shocks tend to allow "axle dance," which means the rear tires actually leave the road surface under certain conditions. Take acceleration, for example: When a quick, driving torque is applied to the rear wheels, it tends to cause power hop*. Another example could be a rough road surface

(Continued on page 28)

*See accompanying glossary.

Only Champion can tell this story

Q. Why are nearly twice as many police cars in the U.S.A. powered by Champion spark plugs?
A. Champions give full-firing power. Put new Champions in your car every 10,000 miles. You'll get an immediate boost
Q. Why do over twice as many car makers—including Rolls Royce—specify Champion spark plugs?
A. Champions give full-firing power.
Q. Why do all the world's major airlines use Champion spark plugs?
A. Champions give full-firing power. Put new Champions in your car every 10,000 miles. You'll get an immediate boost in horsepower...and save gasoline, too!
Q. Why do 8 out of 10 truck makers use Champion spark plugs?
A. Champions give full-firing power. Put new Champions in your car every 10,000 miles. You'll get an immediate boost in horsepower...and save gasoline, too!
CHAMPION

Magazines are an excellent way to reach your customers with sales messages like these – because 90% of all U.S. car-owning families read magazines.* Champion is reaching your customers with regular monthly insertions in *Life, Post, Reader's Digest, Look, Mechanix Illustrated, Popular Mechanics* and *Popular Science.*

*Steward, Dougall & Associates – Survey for M. A. B.

World's favorite spark plug — engineered for every car built by FORD, GENERAL MOTORS, CHRYSLER,

Champion's leadership can mean more spark plug sales for you

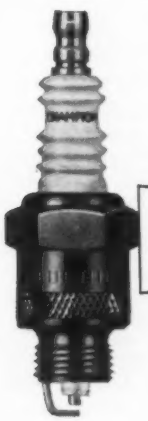
Champion ads are telling your customers why—in fields where peak engine performance is a must—the first choice in spark plugs is Champion—and reminding those customers to install new Champions every 10,000 miles!

● During every month of 1958, full-page advertisements like those shown at left will appear in leading national magazines . . . preselling your customers on the fact that Champions are — in the opinion of experts — the finest spark plugs obtainable.

And every one of these advertisements reminds your customers of the importance of installing new Champions *every 10,000 miles.* This helps make more sales for you!

These ads tell why Champions are the unchallenged leader in field after field. In airlines . . . police cars . . . as original equipment in passenger cars . . . in trucks . . . fire engines . . . outboard motors . . . farm tractors . . . race cars . . . Champions are the No. 1 choice of the experts. Every one of these fields demands the *best possible* performance from engine components. And — *in every one* — the first choice for spark plugs is CHAMPION.

It's a story that will impress your customers. And — coupled with a strong reminder to install new Champions every 10,000 miles — it's a story that can make *more sales for you.*



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AMERICAN MOTORS, STUDEBAKER-PACKARD, and every major foreign maker

A "Selling Ride" . . . CONTINUED

that causes wheel hop*. Under these conditions, the tires act somewhat like rubber balls, and actually transmit a bouncing motion. This results in loss of traction, and excessive tire wear. Lost traction means less pulling effort, and, consequently, less mileage.

Good shock absorbers improve road hugging; which will mean longer tire life and increased performance.

Stability covers a wide area of vehicle operation. One example is cornering—the ability of a vehicle to negotiate curves without undue sway or sideslip. Here is another important role of good shock absorbers, for a car rounding a curve—especially on a rough-surfaced road—must have all four wheels on the ground at all times, or it will go into a sideways skid.

Cornering ability is a safety factor that can play a big part in the customer's decision to replace shocks. The importance of maintaining road contact while rounding curves, should be stressed in any discussion of road hugging.

Handling: A complaint of "poor handling" is often hard to diagnose. It can mean that the customer is complaining of "wheelfight"*, "wheel flutter"*, "wheel wobble"*, "shimmy"*, or "floatation"*. Chances are the customer does not understand the technicalities, but he does know "it doesn't handle right." Barring actual mechanical looseness or wear, new shock absorbers will be the answer to the majority of poor-handling complaints.

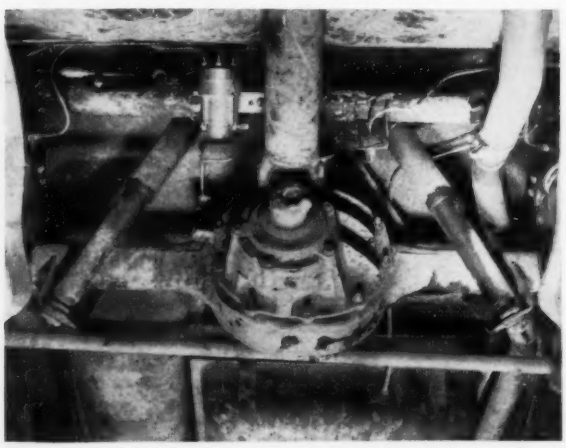
Perhaps the best way to recommend repairs to overcome a poor-handling complaint is to conduct a thorough visual inspection, then road test the car. If inspection reveals sagged springs, loose tie rod ends, loose steering gear, etc., mechanical repairs or adjustments must be made before new shock absorbers are installed.

If the vehicle is mechanically sound, road test to pinpoint actual difficulty. If the complaint is primarily lack of high speed stability—which is a continual sensation of float, shake or wheelfight—it's a sign of weak shock absorbers. This condition is aggravated by out-of-balance wheels. The remedy then, is new shock absorbers, and a wheel balance.

SHOCKS AREN'T "CURE-ALLS"

A point to remember when explaining the benefits of new shock absorbers to customers is the fact that they cannot cure all ills of riding or driving.

Rear shocks are often "straddle mounted," upper connections near center of underbody, lower near outside of axle housing. Such installation adds greatly to the vehicle's stability.



GLOSSARY

(from information contained in the 1957 S.A.E. Handbook)

Spring Rate: The change of load of a spring per unit deflection, taken as a mean between loading and unloading at a specified load.

Sprung Weight: All weight which is supported by the suspension, including portions of the weight of the suspension members.

Pitch: The oscillation of the sprung mass which consists primarily of angular displacement about a traverse axis.

Roll: Angular displacement of the sprung mass about a central longitudinal axis with respect to its static position.

Power Hop: An oscillatory hopping motion of a single wheel or pair of wheels which occurs when tractive force is applied in forward or reverse motion of the vehicle.

Wheel Hop: Vertical oscillatory motion of a wheel between road surface and sprung mass.

Wheelfight: A rotary disturbance of the steering wheel produced by forces acting on steerable wheels.

Wheel Flutter: Forced oscillation of steerable wheels about their steering axis.

Wheel Wobble: A self-excited oscillation of steerable wheels about their steering axis, occurring without appreciable tramp.

Shimmy: A self-excited oscillation of a pair of steerable wheels about their steering axis, accompanied by appreciable tramp.

Transient Motion (Floatation): Any motion which has not reached, or has ceased to be steady state.

Excessive bottoming due to sagging or weak springs, cannot be helped by new shocks. Nor can shimmy caused by loose king pins, or bad front wheel bearings. On the other hand, weak or worn shocks **can** result in many costly, unsafe and uncomfortable conditions. This is the area in which mechanics can be of real service to the car owners.

NEW DEVELOPMENTS

Recently, major improvements have been made in the design and operation of replacement shock absorbers. One example is the "AjustOmatic" by Gabriel. This is a shock absorber which can be adjusted by hand to provide a wide range of ride control.

The "soft" adjustment is designed for the motorist who places greatest emphasis on a well-cushioned ride, usually at moderate speeds over good roads. "Normal" (medium) setting is calibrated for the driver who wants improved stability over a standard ride, while staying within the "good comfort" range. "Firm" is for the driver seeking maximum stability, particularly at high speeds or where the going is rough.

The shock absorber industry, as is typical of the whole automotive business, has been constantly working to improve the product. Excellent replacement shocks are available today. They can provide your customers with a "new car ride," plus a marked degree of safety and handling ease. Proper merchandising based on a sound knowledge of basic design, function and limits, plus the ability to give sound down-to-earth reasons why defective shocks should be replaced, will promote better customer relations, and increased profits.

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to assure quietness with minimum back pressure even after years of use!

This feature—plus many more—guarantees top customer satisfaction

Exclusive, patented CONTRA-MATIC self-cleaning louvres assure continuous peak operating efficiency. But this is only one of the many features that make International Parts Mufflers quiet, efficient, long-lasting. Extra heavy steel, double-wrapped construction, continuous welded seams, all-welded internal baffles provide lasting strength. Special beaded body gives extra rigidity, "Silikote" coating offers rust and corrosion protection. Good engineering backed by careful research, through testing and inspection in every step of production—all these combine with exclusive, superior design to pay off BIG in sales appeal and user satisfaction. **INTERNATIONAL PARTS MUFFLERS ARE BACKED BY A WRITTEN LIFETIME GUARANTEE.**

"Contra-Matic" self cleaning louvres keep mufflers operating at peak efficiency year after year

Gases passing through CONTRA-MATIC louvres are directed toward each other to break up noise sound waves. Consequently, each louvre is continually being blown clean by the action of its contra louvre. The result is a muffler that provides constant super-silencing with lowest possible back pressure.

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AUTOMOTIVE BUSINESS KNOW-HOW

"So you want to open a service shop?"

It's like leaving home to "go on your own" the first time. Here's "boot training" for the ex-salaried-employe embarking on the tossing seas of independent enterprise.

Part II — How, What and Where?

By HERB CARRIER, Detroit Editor
and
DR. GEORGE W. FIELD, Wayne State University

• THERE ARE THREE big questions to answer long before a new independent shop opens its door: How will it be owned? What kind of a shop will it be? Where will it be located?

The prospective independent businessman who aims to enter the automotive servicing field, must firm-up basic approaches and policies before taking the actual plunge. Perhaps his number one consideration is ownership. Shall he "go it alone," get a partner, or form a corporation? Each type of ownership, of course, offers advantages and disadvantages.

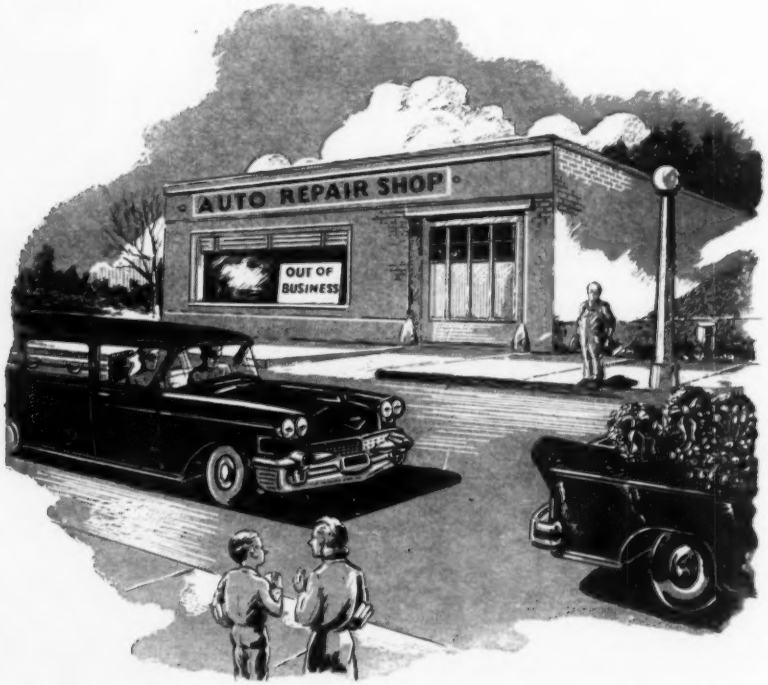
SOLE OWNERSHIP

If you decide to be 100 per cent your own boss, you'll keep all the profits. There will be much less governmental regulation. Fewer reports will have to be filled out, and you'll enjoy certain tax advantages. It's the easiest, most uncomplicated way to start a new business.

On the debit side, a sole owner must be prepared to stand all losses and creditor claims. In some cases, creditors can, and will, attach the personal assets of a sole proprietor. Then too, working capital will be limited to what one man can raise.

GENERAL PARTNERSHIP

By taking in one or more partners, some of the disadvantages of sole ownership can be overcome. But, you'll



While the loss of a friend is grievous enough in itself, it can also be business disaster for you if you've set your shop up as a simple partnership. Consider all possibilities when you decide ownership.

have to give up some of the advantages too—including a share of the profits.

In a partnership, there is a possibility of pooling talents. Maybe you are a whale of a tune-up man, but all thumbs when it comes to doing front end work. By getting together with a good front end man, you can literally double your potential for business.

A partner, or several partners, will also increase available working capital, which will help a struggling new business over possible dry spells.

Most partnerships are automatically dissolved in the event of death of one or more partners. The survivor is liable to the estate. This often means a forced sale of the business at disaster prices. Many businesses with bright futures have been nipped in the bud when a partner unexpectedly passed on to his reward.

MUST BE ABLE TO WORK TOGETHER

One of the most important considerations for partnership is the ability to work together. This does not mean you must agree wholeheartedly on every issue. In fact, the general impression is that when two partners agree on every point, there is no need for a partnership. One man could make all the decisions himself.

Feeling free to discuss issues as they arise and to cover both sides of the story honestly, without friction or animosity, is the essential ingredient of a working partnership.

One of the best ways to make up your mind about a prospective partner is to work with him. Some mechanics seem to work best when their stall looks like the inside of Fibber Magee's closet. They appear to enjoy waddling through spilled oil, grease, and empty coffee cups. Mechanically, their work is good; but their work habits may drive an orderly mechanic to the furthest possible stall, or even to another shop. Consider all sides of the question when deciding the selection of a working partner. You'll probably spend more time with your partner than with your wife; choose him just as carefully.

The safest, most complex form of business ownership is the corporation. Perhaps its greatest single advantage is that legal liability is limited to the amount invested. You can still lose your shirt in a corporation, but not your complete wardrobe.

Corporations can raise additional working capital through the sale of shares of stock. This is a definite advantage. However, it's possible to lose control of the business by letting out too much stock.

Corporations are closely regulated by state law. Usually a lawyer must be constantly at hand to offer legal advice on major problems or decisions. Corporate taxes dip deeply into profits. In addition to a personal income tax, you (as a corporation) will be required to pay taxes on corporate income. Capital stocks are also liable to taxes.

Successful corporations can enjoy unusually long life. Death of a principal owner doesn't necessarily dissolve the business.

Most big businesses are corporations primarily for the reasons discussed here. If you don't mind red tape, and have the money to spend on incorporating (minimum cost is about $300.00) a corporation might be best for you.

WHAT KIND OF SHOP?

Most often, a working mechanic planning to go into business for himself, has a pretty good idea of the kind of shop he would like. A front end man thinks about a front end, collision, or brake shop. A tune-up specialist thinks about an electrical, carburetion, or light repair shop.

This is fine. However, it might not always be possible. If you have set any boundaries on the area in which you'd like to become established, you'll have to scout around the neighborhood to see what kind of shops are already in operation. Maybe someone else beat you to it. You must research to find the neighborhood needs. And, finally, your choice of business might easily be limited by

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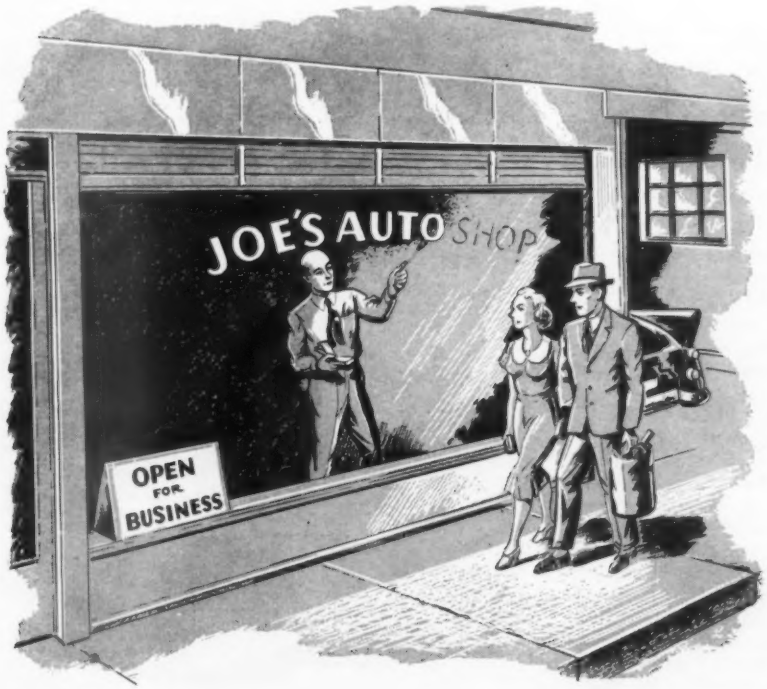
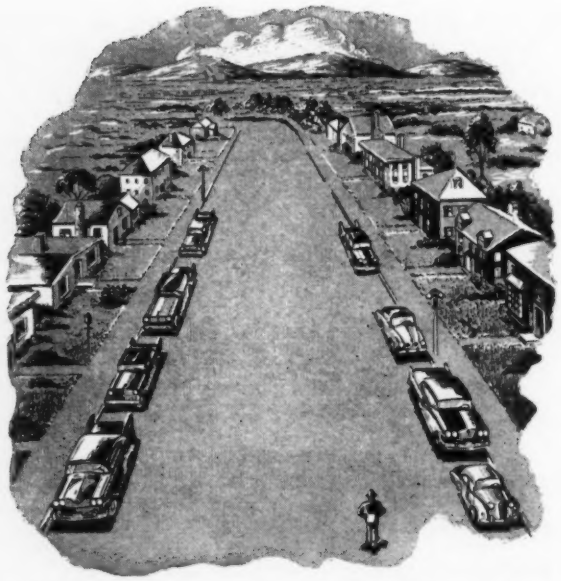


To succeed faster, be sure you offer the type of service the neighborhood needs and wants. Either select the area to fit your own preferences in jobs, or adapt your skills to work that's most saleable.



Checking over the autos on a residential street can tell you a lot about the service requirements and practices of their owners.

Opening A Shop? . . . CONTINUED

the amount of capital you have to invest. Generally, the heavier repair services (transmission, engine rebuilding, etc.) require a greater cash outlay for tools and equipment than do the light repair fields. However, even a small tune-up shop can have several thousand dollars wrapped up in equipment.

PICKING THE SITE

Looking for the best spot to open a service shop in any one neighborhood is usually quite simple—look for the most successful garage. Remember, you aren't the first or only mechanic to have the idea of an independent shop. So, you'll probably have to scratch-off the 100% location, and settle for next best. Whatever you do, don't look haphazardly. Big companies make expensive scientific studies before they decide upon a new location. You can't do this, but you can look around, and give the idea some intelligent thought.

WHAT TO LOOK FOR

Market Potential: The number, type, and age of the vehicles in your proposed area is related directly to your chance of getting some of them into your shop. Generally speaking, cars two to three years old represent the best service potential, although this does not always hold true. In some cases, your business might depend on cars considerably older or newer.

It's also important to know something about the buying habits and attitudes of the vehicle owners. For example, do most of them prefer to have their cars serviced while they are at work? If so, this is bad if you plan to open a shop in a residential neighborhood. How about the feelings of people in the area towards established dealerships versus an independent service shop or a gas station? Would they welcome a new face in the neighborhood, or are they completely sold on existing facilities?

Car buying habits must also be considered. If most potential customers in the area trade for new cars every year or two, it might not be wise to open an engine rebuilding shop intended to cater to local traffic. On the other hand, this might be a good area for a spic 'n span tune-up specialty shop.

Sub-let Market: In some areas there is a ready market for sub-let repairs. Large fleets, dealers and specialty shops, quite often let out a good share of the work they are not equipped to handle. For instance, a high volume dealer might be a likely prospect for a reasonable amount of auto glass work. A mechanic with extensive experience in the glass replacement field, would stand a good chance of getting steady work if he located near a dealer who farmed out glass work.

You can't afford to be timid when it comes to researching such things. It's best to walk right up to the service manager, the fleet supervisor, or the trucking superintendent and tell him your intentions. A polite "How about it?" will often get you the answer you'd otherwise have to assume. Lining up a few prospective accounts is good success insurance.

Nearness To Suppliers: If your particular kind of business will be handling a lot of fast-moving merchandise, it might be smart to locate as near your supplier as possible. This will help you in several ways. First, it will cut down your own inventory by letting the supplier do most of the warehousing for you. You'll save the expense of extensive stock, plus the added costs of storage bins and large storage areas. Then too, you can't stock everything. If your source of supply is nearby, you'll save time and money in obtaining parts.

Care must be taken, however, in trying to strike a good balance of market potential and source of supply. Try not to sacrifice one for the sake of the other. In a good traffic spot you might find yourself slow in getting the work out because of time spent on the road for parts. Even if you don't personally chase parts, you'll have to hire a man to do it. That means an extra salary. On the other hand, being close to supply means little if you can't get traffic in the shop.

Site Availability: Occasionally, all research points to a specific site as being a "natural"; but for some reason (it seems to you) no one else seems to think so. At least, no one has opened up a business for which you feel the

(Continued on page 34)

Use direct approach to get facts about possible sub-let work. Introduce yourself to the service manager and ask him frankly.

In the automotive after-market . . .

THERE'S NO BUSINESS LIKE CHEVROLET BUSINESS!

BECAUSE . . . One out of every four cars and trucks on the road is a Chevrolet . . . that's more than any other make by far!

BECAUSE . . . Your Chevrolet dealer can be your dependable one-stop source for genuine Chevrolet parts.

Over 15,000,000 Chevrolet cars and trucks on the road! That's a big service market! Your Chevrolet dealer is ready, willing and able to help you serve that market.

You can make him a convenient, one-stop source for genuine Chevrolet parts.

Each genuine Chevrolet part is built of the same high-quality materials and to the same rigid engineering standards as the original part. All are made to work together —made for a Chevrolet.

Your Chevrolet dealer has available service aids that can help you give better and more profitable service to Chevrolet owners. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

MAKE YOUR CHEVROLET DEALER YOUR PARTNER IN SERVICE
. . . HE IS READY, WILLING AND ABLE TO SERVE YOU!

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Weigh carefully the advantages of buying, renting or constructing the building for your shop. Each case has its own merits, but there's only one "best" for you at the time you launch your own enterprise.

Opening A Shop? . . . CONTINUED

site is tailor made. The word of caution here is, "Look deeper for the reason."

Maybe zoning laws prohibit your type of business. Maybe another garage, actually outside of the immediate market area, has the whole neighborhood sewed up. There could be a dozen good reasons—all of them buried where they aren't easily seen—why this spot should be avoided.

Be extra cautious when taking over a shop that has gone out of business. Investigate thoroughly for the reason the previous owner didn't make a go of it. It's a common error to assume that because someone else once had a service shop there, it's a good spot.

Competition: Look carefully at the competition in your proposed area. Try to estimate, as best you can, the per cent of market potential it seems to be getting. This figure should be based on the market potential your previous survey indicated.

Be critical as to the amount of business you believe you could get in spite of competition, or because of it (honest competition can be a trade builder). It's not uncommon to find large businesses doing well, even though located across the street from each other. A good shop nearby can force you to operate more efficiently, offer better work and service. It's also possible to work with competition in swapping jobs, wholesaling work, or subletting. But, above all, don't be too optimistic when opening up alongside an established competitor.

BUY, BUILD, OR RENT?

Fifty-eight per cent of independent retailers rent their places of business; 42 per cent own their buildings.

Renting offers some big advantages. For one thing, it requires less capital outlay. Several months' rent is easier to come by than even the down payment on a desirable piece of business property. Another thing, you can always change locations if you are renting. If you made a bad choice of location, all is not lost when you rent.

Owning business property is a business in itself. It can complicate the job of running a profitable repair business. Unless you already own property in a strategic location, it's usually best to rent, at least until you are firmly established. Beware, of course, of cheap rentals. There's usually a good reason for cheapness.

There are several types of rental contracts. It's possible to rent on a "so much per month" basis, a flat, fixed figure which doesn't vary month-to-month. You can also rent on a "per cent of gross profit," or "per cent of gross sales" basis. The more profit you show the more rent you pay. This involves a little more bookkeeping, but it has the advantage of being tied in with what you're making. In a bad month, your rent goes down proportionately. Some owners have firm policies along these lines; and if this proves the case, you'll just have to accept them.

Advantages of owning or building include being able to design a layout that will be most efficient for your business. Then, too, you can forget about being forced out of business through loss of lease.

The final possibility in obtaining your own shop is to buy a going business. Here, again, careful investigation is absolutely necessary. You'll most likely need help in evaluating the owner's books. Only a competent accountant can be relied upon for this job.

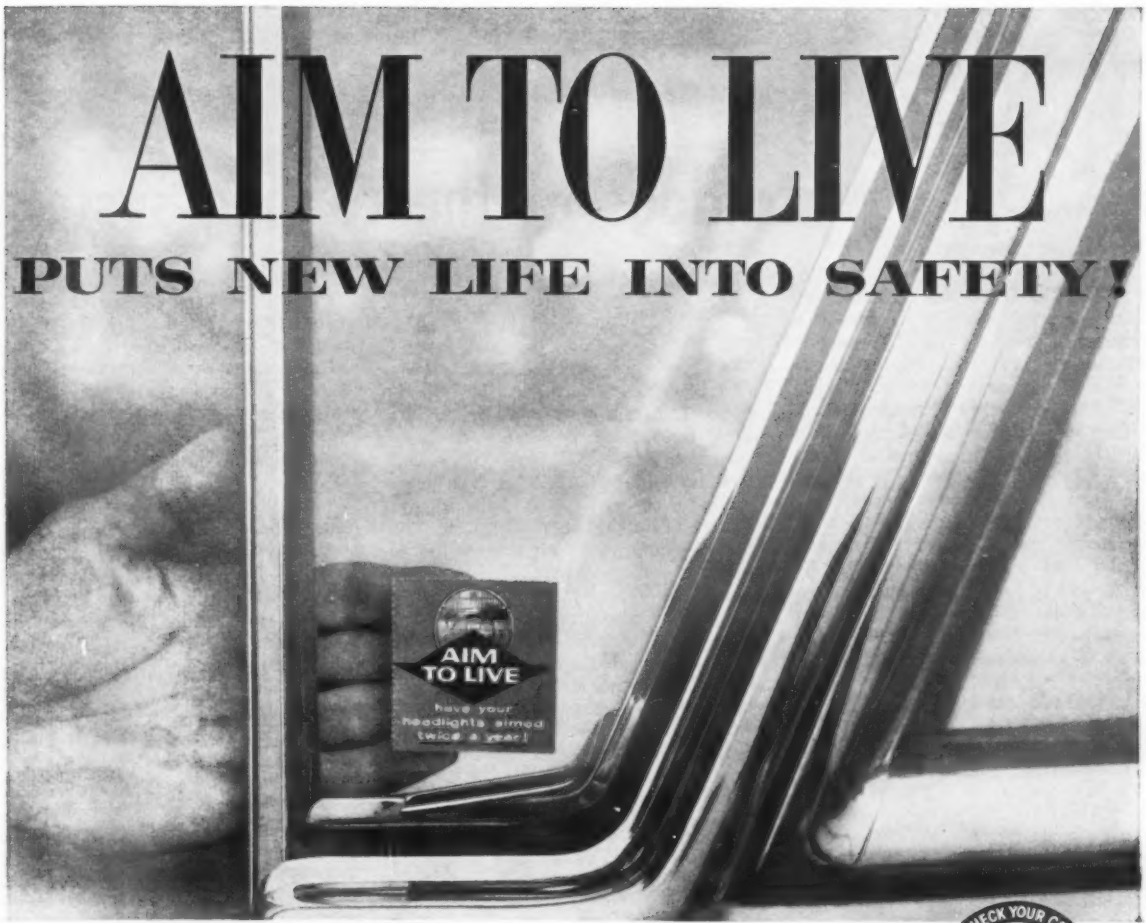
You must also study the inventory which is being offered in the sale. There may be many items that would be of little use to you in your business. The lease arrangement should be looked into. Sometimes leases are non-renewable and non-transferable. The owner's business reputation must be carefully considered. If he has many dissatisfied customers, it might pose a definite handicap to the new owner.

The equipment should be closely investigated. The owner may want more for his used equipment than the cost of new. When a selling owner bases his asking price on inventory, equipment, and "good will" (most of them do), it's up to the buyer to see that he gets value received in each.

Once you have decided upon the kind of business, the best site, and the actual building, you're ready to set up.

AIM TO LIVE

PUTS NEW LIFE INTO SAFETY!



LET HEADLIGHT AIMING BE THE STARTING POINT OF YOUR "SAFETY CIRCLE" CHECK!

CHECK YOUR CAR • CHECK YOUR DRIVING • CHECK ACCIDENTS
Join the "CIRCLE OF SAFETY"

Many dealers have offered free headlight aiming in their localities to stimulate immediate action to this night-driving safety service. Other dealers have spearheaded local AIM TO LIVE activity by aiming the headlights on police and municipal vehicles as a public service.

Keep your customers safety-minded, and they'll ask you to keep them safety-serviced. And the best place to start a complete safety check is with headlight aiming.

Aim To Live dealers, who actively promote this program, are enjoying outstanding results. They have built invaluable good will as safety leaders in their community. They have stimulated local action for headlight aiming. And they have aroused greater interest in all-around safety service.

Now's the time to feature headlight aiming! Motorists are preparing for vacation travel and many more miles of nighttime driving. So, be sure you AIM TO SERVE with AIM TO LIVE!

CHECK HEADLIGHTS REGULARLY
AIM THEM ACCURATELY FOR SAFETY

General Motors

CHEVROLET • PONTIAC • OLDSMOBILE • BUICK • CADILLAC • GMC TRUCK • GUIDE • AC

Working separately, yet as a team, thermostats and pressure caps often hold the answer to cooling system efficiency, and can rightfully be called . . .

Watchdogs of the cooling system

By D. E. HERBERT

• ANYONE WHO has tried to regulate room temperature to satisfy the finicky tastes of a thin-blooded Mother-In-Law will appreciate the job of an engine thermostat. Working all by itself in a sea of swirling liquid, which can vary in temperature from 50° below zero to over 200° above zero (F), the thermostat is expected to accurately control the flow of coolant so that the engine operates within its most efficient heat range.

Not only must the thermostat live with widely fluctuating temperatures, but it's not uncommon to find thermostats "carrying on" under a pressure of 15 pounds per square inch.

BASIC TYPES

There are two, possibly three, types of thermostats in general use today. The first is a bellows type; the second is a pellet type; and the third is a bi-metal type. Regardless of type—bellows, pellet, or bi-metal—an engine thermostat is simply a heat-operated valve.

Bellows Type: The bellows type thermostat is constructed to utilize vaporizing liquid as its operating force. The hollow bellows—an accordion-like brass assembly—is partially filled with a minute quantity of alcohol, ether or similar substance. Then a vacuum is created within the bellows, and finally it's sealed air tight. When the liquid within the bellows is subjected to heat, it expands and vaporizes, which breaks the internal vacuum, causing the bellows to expand.

The bellows is connected to a valve which, when seated, prevents engine coolant from circulating through the radiator. Consequently, as the bellows expand the valve is forced off its seat, permitting the flow of coolant.

Prior to the early 1940's, this type of thermostat could be counted upon to deliver satisfactory performance for untold thousands of miles. Even today, there are some cars running around with well over 150,000 miles on the odometer, and still carrying the original thermostat.

In the years following World War II, automotive design underwent some rather drastic changes. Two changes directly affected thermostat design. First, there was, and still is, a dramatic yearly increase of engine horsepower. Second, the cars were being built with a lower silhouette; a trend which is continuing.

Both these changes resulted in conflicting demands. On one hand, the increased engine size called for greater cooling capacity. On the other hand, the lower hood line called for a decrease in radiator size.

PRESSURIZED SYSTEMS THE ANSWER

Through extensive research, it was found impractical to materially step up water pump output. Even the use of high pressure pumps failed to give the desired increase in circulation. Engineers delved into the design characteristics of recirculating pumps, and found that everything checked out. It appeared that the pumps were producing optimum flow according to design specifications. Finally, this was proved wrong when someone said, in effect, "How come we always check pump flow with cool water? Why not simulate engine conditions, and check the flow with hot water?"

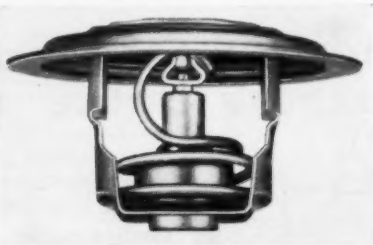
Then came the revelation!

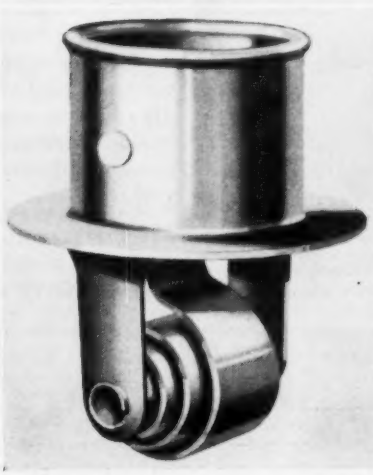
Water temperature directly influenced pump output. At temperatures as low as 125°F, for a 50% solution of ethyl-alcohol, or 160°F for 100% water, the pump started losing efficiency at high speed operation.

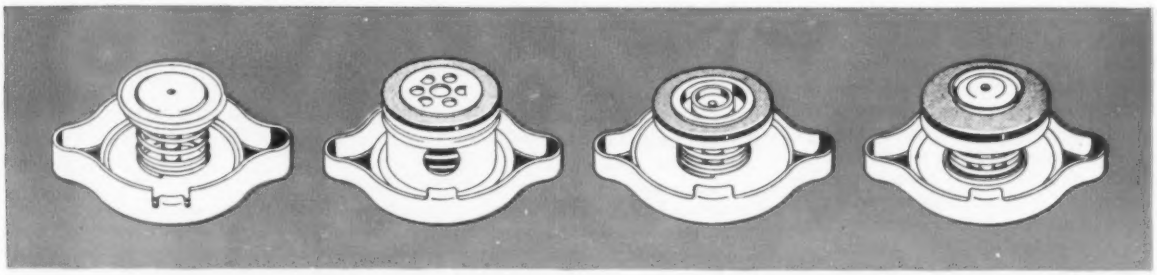
More amazing, *all* circulation stopped at coolant sea level boiling point (212°F for water, 182°F for 50% alcohol solution).

Above: Bellows-type thermostat. Right: Bi-metal or butterfly-type thermostat.

At left and below are two pellet-type thermostats in common use today.







Pressure caps can usually be identified by the lower sealing gasket, and by the coiled spring. The width of the locking ears generally indicates the extent of pressurization—wider ears for greater pressure. Always use an authorized replacement cap.

Engineering jargon calls this cavitation—meaning, of course, that the pump undergoes a vapor-lock. Once the cause of poor high speed circulation was discovered, the cure was not far off. Soon it was found that cavitation could be controlled by increasing the boiling point of the coolant. The most satisfactory way to do this, in a closed cooling system, is to raise the pressure on the coolant.

For each pound increase in pressure, the boiling point rises 3°F. A system with a 15 lb. cap will raise the boiling point of its coolant 45°F. Also it was found that with each 4 lb. pressure increase, an overall cooling efficiency increase of approximately 10% resulted. Armed with this information, it was possible to design a system which would adequately cool high displacement engines without materially increasing radiator size. In fact, most modern radiators are somewhat smaller in physical dimensions than they were some 10 years ago.

ENTIRE SYSTEM STRENGTHENED

Pressurizing an automotive cooling system simply involves installing a pressure cap, plus, of course, strengthening the entire system to withstand the internal pressure. Also, a specially designed filler neck must be incorporated into the radiator. The filler neck is made with two sealing seats—an upper and a lower. An overflow tube extends outward from a point midway between the two seats.

The cap itself usually consists of a pressure valve, a vacuum valve, a pressure valve spring, a lower seal (rubber gasket), and the metal body which contains the cam engaging ears and the upper (metal) seal.

NOT UNDER CONTINUAL PRESSURE

Pressure caps do not necessarily mean that the system is continually under pressure. Pressure is built up only as the coolant, and air above the coolant expands as heat is applied. Because the cap is sealed tightly, this expansion is trapped, so to speak, and results in a pressure build up.

If the cap were designed to maintain a 7 lb. pressure, for example, the coiled spring would be calibrated so that 7 lbs. pressure would overcome spring tension and permit internal pressure to lift the lower seal off its seat, thereby allowing pressure relief through the overflow tube.

When the engine is stopped, the radiator cools off. This is where the other valve comes in. To prevent a vacuum from being formed, the valve opens to admit atmospheric pressure into the radiator. This is necessary because the expanded coolant and air in the radiator contracts on cooling and actually occupies less space. The entire space above the fluid level must be exposed to atmospheric pressure, or a vacuum will result during the cooling down process.

Up to this point, engineers thought they had the problem whipped. Cooling systems were pressurized to about 4 to 7 lbs.

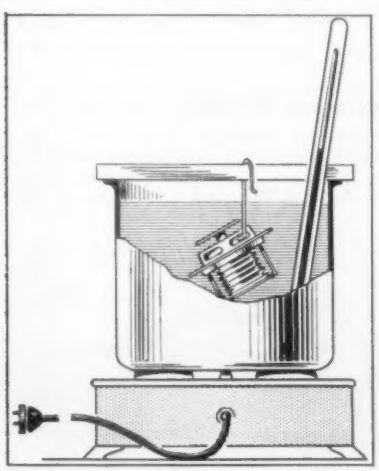
The increase in boiling point, and the increase in system efficiency scaled out to be enough to assure adequate cooling for all normal driving conditions.

MORE PROBLEMS DEVELOP

However, pressurized systems led to another problem. In 1940, for example, an army vehicle powered by a Cummings-Diesel engine, was severely damaged by overheating which resulted from an almost complete stoppage of circulation. This particular system was constructed to maintain a maximum 3½ lbs. pressure. Yet the coolant boiled, and cap pressure rose to 22 lbs.

Later inspection revealed that pressurization in the expansion tank was not limited to the vent setting of the pressure cap. The conclusion was, therefore, that vapor was generated by engine heat faster than it could be vented by the cap. Consequently, the *pressure* kept the bellows-type thermostat *closed* even though coolant temperature was more than enough to open it. Conclusion? Don't use

(Continued on following page)



A pan of water, a source of heat and a thermometer are all that is needed to check thermostats for correct opening temperature.

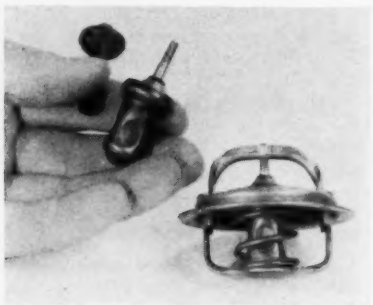
Several types of testers are available for checking pressure caps.

Cooling System . . . CONTINUED

bellows-type thermostats in pressurized cooling systems.

Pellet Type: Thermostat manufacturers soon solved this problem by coming up with thermostats which are not affected by pressure. The one outstanding example is the pellet type thermostat. This type uses a metallic thermal element, and is generally much less pressure sensitive than the bellows type.

The active material inside the pellet can be either in the form of a paste, or it can be solid metallic crystals. As the pellet absorbs heat, the paste (or crystals) liquifies and increases in volume. Expansion forces the piston up to open the thermostat valve against the tension of the coiled spring to permit full circulation of water through the radiator. When coolant temperature falls, spring tension closes the valve as the mixture cools and returns to the paste (or crystal) state.



Working parts of a Standard-Thomson pellet-type thermostat. The brass cartridge encloses a rubber sleeve surrounded by a wax-like mineral which expands with increasing temperatures, opening the thermostat.

Thermostats also serve to allow the engine to warm up rapidly, and, in cool weather, actually contribute much to make sure the engine keeps warm.

Quick warm-up is important to get the engine to normal operating temperature as rapidly as possible, and to provide heat for passengers, via the car heater, without undue delay.

Also, the quicker an engine warms up, the better will be the gas mileage because of more efficient engine operation, and less carburetor "choking." A cold engine tends to allow harmful blow-by of combustion gases into the crankcase. This results in sludge formation and rapid deterioration of engine oil. It can also cause corrosion of metal parts.

REQUIRE LITTLE SERVICE

Fortunately, neither the thermostat, nor the pressure cap, require much in the way of service. Periodic flushing of the cooling system with recommended agents, plus the installation of rust inhibitors will go a long way to guarantee trouble-free operation of the thermostat and the entire cooling system. If the engine does overheat and a stuck thermostat is suspected, it can be removed for a bench check.

Accurate testers are available which quickly tell the operating efficiency of thermostats. Generally, all the test involves is a container suitable to hold sufficient water for testing purposes, a source of heat, a thermometer, and a fine wire (or string) which is inserted under the valve so the thermostat can be lowered into the water.

Care should be taken not to allow the thermostat to touch any part of the container, especially the bottom, as this would result in an inaccurate reading.

With the thermostat properly suspended, and a thermometer in the water, heat is applied to the container and the water is gently agitated. The instant the valve opens enough to allow the thermostat to fall off the wire, a reading is taken from the thermometer. This is the actual opening temperature, and it should be within 3° of specifications. A thermostat 5° or 10° off specifications should be replaced.

Pressure caps only require an occasional inspection of the rubber seal. Some anti-freeze solutions are harmful to rubber, and should be avoided. Also, some pressure caps have a vacuum valve which is loose enough to rattle when shaken. This is a fairly good test on certain caps, but on other caps it is valueless. When installing a replacement cap, be sure to keep within manufacturers ratings.

Generally speaking, a pressure cap should not be installed on an atmospheric system. There are some vehicles which list pressure caps as optional. If in doubt, consult an authorized manual. Sometimes a pressure radiator can be determined from an atmospheric radiator by the design of the tanks. Most all pressure tanks are rounded. Atmospheric tanks tend to have squared corners.

It's not a good policy to install a pressure cap to compensate for overheating. A pressure cap installed on an atmospheric system, especially one with a bellows-type thermostat is bound to lead to difficulty.

Likewise, a bellows thermostat installed in a pressure system can also lead to overheating problems, and, perhaps, serious damage.

Knowing what cap and what thermostat go with what system will help in understanding cooling system problems. Then, by sticking with the rules, you need never make embarrassing and costly mistakes when servicing either unit.

Adjusting the Dual SU Carburetors Used on British Sports Cars

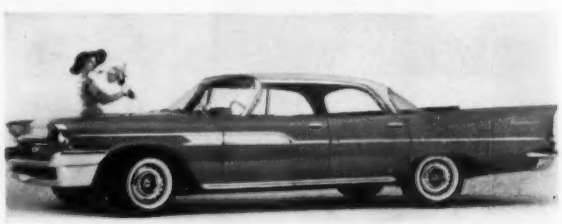
As most British sports cars use dual SU carburetors, diagnosis of spark plugs by *cylinder position* can often indicate whether one carburetor is running richer than the other. To double check this condition quickly, first locate the piston-raising plunger button located on the right side of these carburetors. With the engine running at idle speed, alternately push in each plunger button. If the engine fires with staggered pulsations, carburetors are fairly well synchronized; if engine stalls, the mixture is too lean. However, if the engine is unaffected, the mixture is probably too rich.

On the MG TD's or others not equipped with the plunger button, the same check can be made by inserting a small screw driver into the air horn and carefully lifting each carburetor piston about ¾".

The only mixture control is the main jet protected by a dust cap on the underside of the carburetor. A 5/16" Whitworth or 9/32" U.S. wrench can be used to change mixtures; turning the screw clockwise (upward) will lean mixtures. Turning counter clockwise (downward) will richen mixtures.

Chrysler Announces Dartline Series

This new Chrysler Windsor Dartline features new trim all around and three new exterior colors. It is available with Auto-Pilot, the new superhighway driver assist and is offered in sedan, two and four-door hardtop and Town and Country station wagon models.



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Can't find the Service Manager? Here he is checking work orders—right at his desk and easy to find . . . if you know when. (At such times, of course, he's a "sitting duck" for salesmen, customers, employees, and all comers.)

By E. S. HARRIS
Field Editor

"Where's the service manager?"

Hard to find, the good service manager is a real "man-in-motion." But there's sound purpose in his mobility, and it can pay off richly for the service shop and customer alike.

• STATION YOURSELF at almost any spot in a service operation from the service manager's desk to the lube rack and count the times you hear the question, "Where's the service manager?"

Some service managers have confided in us that the very nature of their job—which makes their presence necessary or desirable in any number of places at the same time—is part of the constant pressure that bears down on them. Regardless of the individual who asks for the service manager—or where that individual is sitting or standing when he asks—he feels that the service manager should be in easy hearing range at the very moment. If it takes the service manager (hereafter referred to as the "SM") a few minutes to reach the reception area from the back of the delivery lot—the inquirer feels just a little irked at having to wait.

MUST COVER A LOT OF GROUND

Some large operations have insulated the SM from a great deal of his legwork by delegating authority and duties to other personnel. While these few SM's can spend more time at their desks than before, the vast majority of their fellows still merit the familiar description: "His brains are connected directly to his feet." For truly, the SM's decisions are based on situations spotted over a wide area, and requiring his personal attention at many places during the working day.

DUTIES MAY VARY WITH SHOP

In an effort to locate the SM for you, we tagged one around during a short afternoon to see where he hid. We had heard several parties asking for this SM during the time it took us to catch him in our locating beam. We studied only one SM in this experiment, for we know that although duties may vary slightly from one shop to another, the working day of a single such individual pretty well covers the typical situations. It serves more convincingly than any composite picture to represent the service operation of all types, sizes and locations.

Our target for the day is Leonard Clarke, service manager for the Bill Luke Chrysler dealership in Phoenix, Ariz. During our long acquaintanceship with Clarke, he has operated shops both smaller and larger than this one; so he brings a general experience to the present job. He's at his desk as often as possible between treks to the various offices and departments where his presence is required.

"Is your job principally public relations or nuts-and-bolts?" we first asked him.

"It's a combination of both," Clarke replied. "Our first and most important job is to keep our customers satisfied, but good service and workmanship alone can't always do this for us. It's possible to deliver a good job and yet have an unhappy customer, so we have to combine the service with public relations and good salesmanship to obtain our goal."

"Then a good mechanical job may still leave a customer dissatisfied?"

"And how! Service work must be properly sold, the customer must be followed up during the job if additional work is found necessary. Then he must be sold the job done when he takes delivery, with an opening left for adjustment if it isn't satisfactory to him. If it happens to be a dealership shop you are managing instead of an independent, then you have the additional task of seeing that product satisfaction is preserved, so he'll remain a prospect for a new car sale at some later date."

THEY ALWAYS WANT "THE BOSS"

"Give us a little more data on the responsibilities of a service manager. Just where are you when everybody

looking for you can't find you hanging over his shoulder at the moment he wants you?"

"Well, remember this, at certain times every member of the buying public feels he must speak to the boss. When he's in that mood he'll ask for the service manager, and no deal he could get from any other member of the shop force would make him happy. This doesn't always mean complaints. My last call to the reception area was to meet a new customer who has moved to Phoenix permanently for his retirement. He intends to spend the remainder of his life here; he drives a Chrysler, and he wanted to become acquainted. It would have been poor psychology or salesmanship to have kept him waiting, and I'd have felt we weren't doing the proper thing if I hadn't personally welcomed him to our shop. I then introduced him to the two service salesmen he will contact in the future and we have cemented a good relationship.

"When I got back to my desk there were two people waiting for me, probably wondering where's the service manager when he's not at his desk? But they didn't have to wait long. I took a couple of phone calls while they were presenting their problems. Both calls could have been handled by other men in the organization, but they asked for the 'service manager' so I handled them to the best of my ability. Had they been switched to someone else under the circumstances, they probably would have felt unhappy.

"SM" ALWAYS HELD RESPONSIBLE

"It's always far easier to switch a disgruntled customer to the service manager than to switch him back to someone else before the problem is settled. It's a fact of life we have to live with. It ties up a lot of our time—but after all, we exist because of their patronage. We can't kick because a lot of the work we have to do could be done by someone else.

"As one of my colleagues commented to me at a service managers' club meeting, 'We seem to be held responsible for everything around here but the weather, and we're often criticized for that.' That's more or less true, so we must accept it and go on from there."

"Aside from this greeting of new customers to your service operation and smoothing ruffled feathers on others, what else puts you on the move and makes you hard to find?"

"Service managers have a number of duties that occur periodically, steadily, or sometimes unexpectedly. Of course there is the little matter of the shop showing a profit, or showing a reasonable percentage of absorption as the dealers term it. This in itself keeps you on the hop checking for leaks or functions which may 'up' shop costs or lose revenue. We must integrate factory or dealer advertising programs.

EMPLOYEE COOPERATION ESSENTIAL

"Then there is the matter of employee relations. The men you work with can spell success or failure for your plans and operations, and they must be constantly consulted for suggestions and information on the results of certain jobs and programs. Without their assistance and cooperation, you had just as well give up. So maintaining contact and good relations is a vital function of the service manager.

"Training programs to instruct new men on their job or to give seasoned men data on new units, must continue at all times. An evening service meeting is held once a month for this purpose. By having it regularly scheduled, we can gather the information and problems to be presented to the men and they can be ready with their suggestions, observations, or gripes—for that is the only time everyone is together with their minds clear for the work at hand. We iron out a lot of trouble, keep up to date on our work, and get a better perspective for the future, at these meetings.

"Every other department in the firm has a stake in the function of the service department, for it is here that the customer is most likely to make contact. Management wants to know his reactions to the operation as a whole; the accounting department may want a session with him; the sales people want to know if he's satisfied with what they sold him or if he's ready for another buy; and, of course, the partsmen get their greatest sales volume through sales made to the man in the reception area. Any one or all, may have well-motivated suggestions for better handling of their prospect in the shop, and the service manager must find the way to apply them. So the service manager may be found in conference with managers of other departments when he can't be found at his desk or on the service floor.

"Knowing that the service manager is responsible to both management and customer for their work, conscientious service men in the department may want to discuss a current mechanical or public relations problem at any time during the working day. Being personally responsible, the problem may send the service manager to the work area or on a road test . . . and away from his desk.

(Continued on page 72)

The Service Manager on a typical "diplomatic mission," answers a call to check out a new car to a proud owner — who the dealer wants to keep as a customer.

One common detour is into the new car make ready department. Here Clarke confers with mechanic Bill Staats (recently from Holland).

By STOKES TAX CONTROLS, INC.

Tax guide and business briefs

Internal Revenue Audits

• NOT ALL TAX RETURNS are audited every year. If your return is to be audited, it may occur in the routine "sampling" of the Internal Revenue Service. Your return may have been selected for special examination because of unusual deductions. In either case, assume that it is a routine examination and get together the data to support the items on your tax return. In discussion with the Internal Revenue Agent, don't plead ignorance when you know the answers. Answer his questions concisely and honestly and let the chips fall where they may. Conversely, don't try to give him a high pressure selling job.

KEEP POLITICS TO YOURSELF

Your opinion about the Democrats or the Republicans or the fairness of the tax laws will have no effect on the Internal Revenue Agent. So you might as well keep them to yourself. The fact that you have paid many, many thousands in taxes to date will not influence the determination of the Internal Revenue Agent that you owe more. Most Internal Revenue Agents are not subject to political pressure. They are accustomed to dealing with taxpayers who have influential friends. Your tax problems should be settled on the merits. They are honest sincere individuals who are out to produce results (more tax) for their employer.

Treat the Internal Revenue Agent as a normal human being. Limit your conversation to weather, baseball scores, etc. Answer his questions concisely and directly without volunteering information. Remember what he asked you and the general extent of your answers. Take him out to lunch. Assume that he would like to go to the best place in the vicinity. Let him tell you about his family and his problems if he feels talkative—just listen. Everything the Revenue Agent says has a purpose. He has a proposition to sell and you have merchandise to sell—both require salesmanship. Most businessmen have not had much experience with these tax boys and they should not let them scare the daylights out of them. You have to assume they won't do you any favors. In fact, you don't want any. All you want is a square deal.

DON'T TALK TOO MUCH

Answer only the questions you are asked. Too much talking has frequently created doubts in the mind of the examiner on items which are entirely legitimate and has led to assessments.

The Agent is making his examination for the purpose of determining the tax due in accordance with his interpretation of the law. He is going to assess you everything he thinks he can legally collect and will determine all questionable items in the Government's favor. He has been instructed to settle the case with you, if possible.

After a verbal agreement is reached with an Internal Revenue Agent, he will calculate the tax deficiency and ask you to sign Form 870 "Waiver of Restrictions on Assessment and Collection of Deficiency in Tax and Acceptance of Overassessment." The Agent may tell you that the calculations will be checked in his office and you do not need to verify his calculations. Never agree to a tax deficiency without checking his calculations. On request, he will loan you his work papers for verification. All calculations should be thoroughly checked by a competent person as to principles, elections and arithmetic. Also keep a copy of all the calculations for comparison with the typed report when received.

REVIEWERS ARE NOT INFALLIBLE

The Review Section is supposed to check his report for errors in principle and mathematical errors. In some instances, errors have passed through various reviewers. In a recent case, the tax deficiency was overstated $7,000. Here are some examples of errors disclosed in the Internal Revenue Agent's calculations:

- If repairs were disallowed in a prior year, depreciation on such repairs is allowable in a subsequent year.
- If repairs are disallowed in the year under examination, taxpayer may be able to choose a faster depreciation method.
- If depreciation is disallowed on company cars in the preceding or currrent year, the gain reported when the cars were sold must also be reduced.
- Where contributions paid were originally reduced because of the percentage limitation, an increase in income increases the contribution deduction.
- In the case of individuals, dividend credit should be allowed in respect to amounts added to income and alleged to be personal expenses paid by a closely held corporation, and charged back. This would apply to any similar items classifiable as dividends.
- In the case of individuals there have been erroneous classification of dividends affecting the dividend credit and erroneous classification of business expense affecting the percent-

"Don't forget the hub caps. Remember, the Hardy's are bringing their five children for dinner tonight."

age limitations on contributions and medical expense.

BE SURE FORM 870 IS DATED

The agent will tender one copy of Form 870 for signature. Ask him to furnish another copy for your files. Interest at 6% runs from the due date of the tax return for the year involved to a date not more than 30 days after the date entered on Form 870. If you fail to enter the date on Form 870, the Internal Revenue Agent can put the case aside for a couple of weeks and interest will keep running until someone enters a date in that space.

Note that interest runs 30 days from the date on Form 870. If the tax is substantial, give the agent a check and you save ½ of 1% interest. If you give the agent a check, write a letter transmitting the check and ask him to initial the copy of the letter for your file. There is frequently a delay of a couple of days to a couple of weeks before the check is deposited. Unless there is proof of delivery of the check, Internal Revenue will compute the interest to the date shown by their bank deposit. Explain to the agent why you need a receipt for the check. Don't try to prepay the interest. Wait until you receive the bill.

Invoices for tax deficiencies and interest are due in ten days. If an invoice for tax and interest is not paid when due, interest at 6% is charged on the tax *and* the interest originally billed from the due date to the date paid.

According to the general rule, interest is computed at 6% from the due date of the return to a date not more than 30 days after the date on the agreement (Form 870) signed by the taxpayer. In computing elapsed time, the Government figures calendar years, calendar months and elapsed days. For instance, the period from March 15, 1955 to December 5, 1957 is two years, eight months, 20 days. In computing interest, years are figured at 6%, months at ½% and days at 1/365th of 6% which is .0164383%. Thus the interest from March 15, 1955 to December 5, 1957 is 16.328767%.

COMPUTING REFUND INTEREST

In the case of a refund, the interest is computed from the actual payment date on a last-in, first-out basis. The latest payments are considered the overpayments and interest is computed from those dates. Where the overassessment is actually refunded, the interest runs to a date not more than 30 days prior to the date of the check. If the refund is applied against some other deficiency, the interest runs to the date of assessment of the deficiency.

If a deficiency in tax is wiped out by a carry-back, the Government computes the interest that would have been payable if there was no carry-back and assesses such interest and then figures the interest on the carry-back. Thus where there are large adjustments, it is possible to have an overassessment of tax and a deficiency in interest.

Don't hesitate to question the interest if you cannot verify. Give them your calculation and let them verify it.

There is still more to be done. Many states require a report of all changes made by U.S. Internal Revenue Agents.

The adjustments made by the Internal Revenue Agent affect the books and may affect income or deductions in subsequent years. Journal entries should be made to record all these adjustments.

Lastly, you should consult your tax advisor to determine whether tax returns or refund claims for subsequent years must be amended because of the agent's adjustments.

To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section

---

WHY PAY MORE
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Some timely tips and suggestions from a front end specialist which will be of help to you in convincing customers that . . .

Tubeless tires are here to stay

By R. L. MARKER

● ARE TUBELESS TIRES better or worse than conventional type tires (with tubes)?

What about blow-outs; tire mileage?

Is it practical to use tubes in tubeless tires?

Is balancing necessary?

These are the questions car owners have been asking daily of shop and service personnel.

Tell them emphatically that the tubeless tire is a better tire! It is actually safer, too.

The tubeless tire cannot be expected to give better mileage than those with tubes, but they are equal to the tube-type tires in every way.

HOW ABOUT BLOW-OUTS?

Blow-outs? When a tire sustains damage such as a cut from a sharp object the carcass is opened. The tube, being less than ⅛ of an inch thick and under pressure, will blow itself out through the opening, ripping the carcass hole wider and releasing the air rapidly, whereas the same hole in a tubeless tire will let the air out much slower, giving the driver more time to get the car under control.

Statistics prove that a comparatively low percentage of automobile fatalities are caused by tire failures—tube or tubeless.

Punctures? We know a tubeless tire with a nail in it may sometimes be run for hundreds of miles without deflating. However, a nail left in the tire will eventually cause additional damage to the carcass.

NOT ALL PUNCTURE SEALING

Many of your car-owner customers have the mistaken idea that all tubeless tires are puncture-sealing, having a semi-fluid compound inside that flows into a vacated nail hole, sealing it automatically. This, of course, is not true. Furthermore the sealant, in some cases, does more harm than good. At high speed or in hot weather, the sealant tends to migrate to the outer center of the tire, with the result that the added weight at this point distorts the tire slightly, making it ride up on the center of the tread. This makes the center portion of the tire wear more rapidly than the rest of the tread.

Movement of the sealant can disturb the balance of the tire, too, causing it to bounce or shimmy at higher speeds.

Tubes *can* be used with tubeless tires but the disadvantages of using tubes outweighs the advantages. Tubeless tires are lighter in weight, run cooler and cost about the same. Tubes add weight, cause the tires to heat up a little more. The cost of five tubes is a factor that will discourage buyers from pursuing the question further.

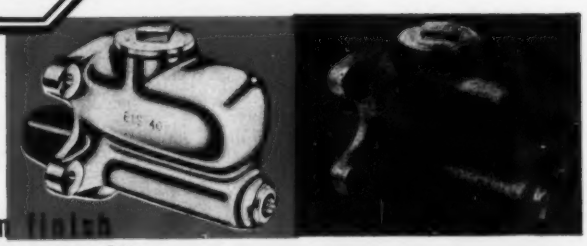
The most frequent cause of trouble with tubes is in the valve, but tubeless tires also have valves.

The greatest advantage of tubeless tires is in the manufacturers' favor, since they are less expensive to build. As yet that reduction in cost has not been shared with the consumer or the distributor.

MANY CARS ARE "UNDER-TIRED"

According to the recommendation of the Tire and Rim Association, many of today's standard equipped cars are under-tired, with the front tires over-

NEW SHELL-MOULDING PROCESS OF EIS CYLINDERS makes them better!



close grain finish
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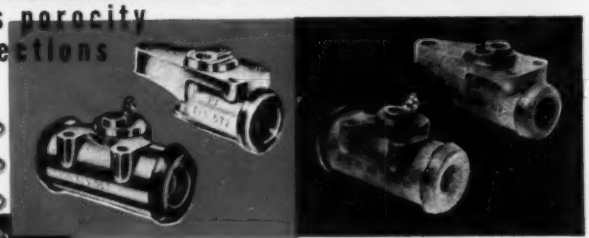


Now, EIS brings you better master and wheel cylinders with its new, Shell-Moulding process! They're precision-made to the extreme and accurately machined with a mirror-like internal finish. Some EIS Master and Wheel Cylinders are available in this new process — many others will follow soon. You'll find that **they're made better — look better — and, they cost no more!**

EIS "E" Series HRC* CUPS WITH EXPANDERS are incorporated in all EIS Wheel Cylinders. Cups are moulded of a specially formulated heat-resisting compound to withstand higher brake drum temperatures caused by higher speeds and faster stops. They are also included in all EIS Wheel Cylinder Repair Kits.

And, for a better sealing job, EIS RIBBED SECONDARY CUPS are incorporated in all EIS Master Cylinders. You'll also find them in all EIS Master Cylinder Repair Kits.

*Heat Resisting Compound

Write for Catalog

EIS AUTOMOTIVE CORP., Middletown, Conn.

loaded as much as 20% and the rear tires appropriate for the load they carry. For proper loading, the car should have two sizes of tires, but since rotation of tires is so important, mixed sizes are not practical. The Tire and Rim Association, however, can only make recommendations, not regulations, so the automobile makers choose to be "under" on the front tires rather than "over" on the rear.

The car manufacturers' recommendations as to air pressure should be followed in all cases. They are based on tests and are proved best for the specific make of car. Overinflation invites damage from sharp objects while making the car ride hard. Underinflation causes heat and wear as well as rubber deterioration.

A LITTLE DEVIATION PERMISSIBLE

Under certain conditions, however, deviations from factory recommendations have their advantages. For high-speed driving on smooth pavement, three or four extra pounds give a little better gas mileage and add to the general stability of the car. For low speed on rough or sandy roads, three or four pounds less will improve the ride and traction without any decrease in gas mileage.

Nylon cord tires have much greater strength to resist bruises or breaks than either rayon or cotton tires. This is true of either the tube-types or the tubeless. Nylon tires tend to stretch a little more than rayon tires when inflated and in 10,000 miles or so they'll actually grow a little. This sometimes causes tiny cracks to appear on the sidewall.

Nylon tires will develop temporary flat spots after standing for several hours in cold weather, but the flat spots will smooth out in three or four miles with no permanent after effects. It would be well to remind nylon tire buyers of this to eliminate doubts in their minds when cold tires "thump." You will save yourself some later trouble if you point this out when you sell the tire.

Four-ply nylon tires will give a better ride and longer mileage than six-ply rayons. Because of cooler operation the rubber stays "live" longer. For this reason, despite the considerably higher cost, the nylon tire is a good investment.

WHEEL BALANCING NO CURE-ALL

Contrary to the convictions of automobile repair men and wheel balancing machine manufacturers, balancing actually has little bearing on tire wear. It has been oversold by many service men, some of whom innocently believe that it can save tires, gas, etc. The primary purpose of balancing is to overcome vibration or shimmy which may appear in any tire, new or old, at higher speeds.

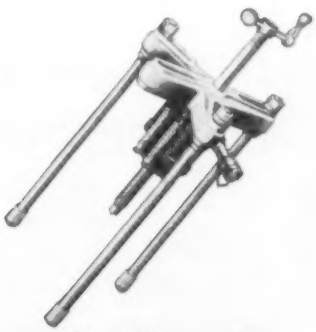
Balancing as a cure for thumping may only lead to grief. The tire continues to thump and just multiplies your customers' dissatisfaction. Don't let your customer talk you into it. You're far better off to talk him out of it.

Editor's note: The reader is referred to the article "Tire thump—its cause and cure" which appeared on page 26 of the September, 1957 issue of A.S.D.)

Steel cord tires, recently introduced by one or more of the major manufacturers, are not practical for passenger cars because of the "metal-fatigue" that the wire is susceptible to in flexing as low pressure tires do. The wire in the tire becomes brittle and breaks. For this reason, steel cord tires must be inflated to much higher pressure. The result is better gas mileage but a "lumber-wagon" ride. A four-ply steel cord tire is the equivalent in strength of a 12-ply nylon tire.

Tubeless tires are the result of progress and are here to stay. It is to be hoped that the cost saving will someday affect the delivered price of new cars.

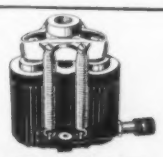
●



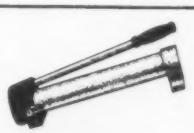
Two pullers in one! Use 2 or 3 jaws with new single head

New OTC combination pullers change quickly from *two* to *three jaws* in seconds to perform a wide variety of push or pulling jobs *fast* in shop or field. Available in either manually operated or hydraulic powered models, these two-way, three-way combination pullers will remove or install gears, bearings, wheels, sprockets, pulleys, couplings, shafts, etc., on all kinds of automotive equipment without binding, damaging distortion or torque effects.

No matter what type automotive mechanical repair or overhaul job you have, you'll find a versatile, time-saving OTC puller tailored to do the job. The patented non-slip jaws of the Grip-O-Matic (above left) will not slip—the harder the pull, the tighter the grip. The Push-Puller (above right) has leg extensions to adapt itself for removing or installing all types of parts.



POWER-TWIN RAMS in 17½, 30, 50 and 100-ton sizes, "Center-Hole" rams power all OTC hydraulic tools.



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New Need for Attention to Car Springs

By D. M. DAVIS, Member, S.A.E.

• THERE ARE FIVE factors in automobile chassis design which are again pointing to the importance of a sound spring-servicing program. These factors are:—

(1) The almost-universal use of leaf springs on the rear of passenger cars.
(2) Lower rate (softer) springs.
(3) Increased horsepower and torque which must be delivered to the rear wheels through these softer springs.
(4) The change to fewer, but wider leaves.
(5) The reduction in percentage of car weight on the rear springs.

These changes make it more important than ever that the leaves act together as a synchronized unit, so that over-stressing of individual leaves is avoided.

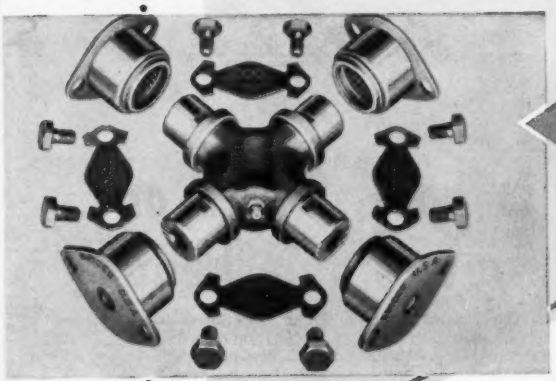
Service men should be alert to conditions which bring on expensive spring maintenance. For example, salesmen carrying samples find that overstressing of rear springs is a frequent condition. The installation of a well designed helper spring which will carry these frequent overloads, absorb the starting and braking torque and not add to the springs' stiffness under normal conditions, will pay handsome dividends in lower spring cost per mile of operation. Further, the maintenance of the drive line geometry in its original position will save universal joints and shock absorbers.

Lubrication should never be applied to springs equipped with anti-friction inserts. Regular inspection of the springs will reveal when the inserts are worn down to the point where metal-to-metal contact is about to occur. When this condition is noticed, the inserts should be renewed, thus preserving the spring's quiet, resilient action, without the danger of over-lubrication which is sure to result if oil is applied to this type of spring.

Finally, inspection for badly misaligned leaves will point out the need for clip replacement to maintain good alignment between all leaves. Replace with a good, strong clip which does not permit metal-to-metal contact.

The springs on today's cars have a staggering job to do, compensating for changes from one to six passengers, yet riding well and holding the road under all conditions. These simple spring service steps are well worth the small amount of time they require. A good rule is to inspect the springs each time the vehicle is lubricated.

Install the *Prestige* line to assure **PERFORMANCE** value!



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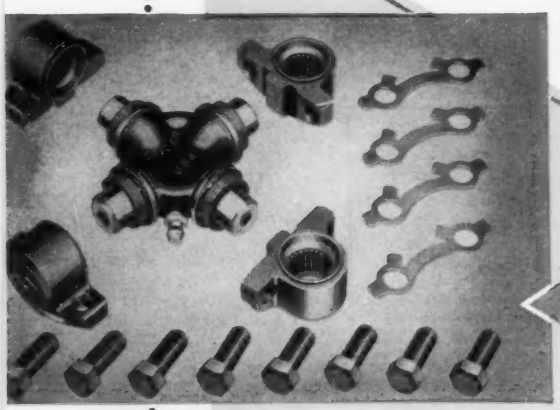

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Air Conditioning Improved On Plymouth's '58 Models

On Plymouth's 1958 air-conditioned cars, a new outlet and a more powerful blower motor improve the distribution of air throughout the car.

In addition, insulation and sealing around the blower housing has been improved to keep engine heat out of the passenger compartment. The new outlet is located at lap level just below the center of the instrument panel.

This outlet directs air up and over the front seat into the rear compartment. The air stream can be aimed to the left or right by means of moveable vanes, and it can be completely shut off by a door.

Air Suspension Tips

On some air suspension cars, it is possible to damage the rear air springs by attempting to remove or uncouple the rear shocks while the rear wheels are raised off the ground. In some instances. shocks installed on air suspended cars are *not* interchangeable with those used on conventional models.

Universal joint service

With the adoption of the three-joint propeller shaft assembly and present trend towards more universals, the independent repair shop should get its house in order to adequately handle this important and profitable service.

● THE STUB BALL YOKE and tube assembly plays a rather important part in the inventory of the shop specializing in universal joint and propeller shaft service. It is a time and trouble saver because it eliminates one weld; eliminates scrap due to incorrect welding; eliminates excess run-out which cannot be corrected; provides for faster assembly and repair; provides an assembly which is easier to straighten.

The stub ball yoke and tube assembly should be used for replacement in shaft sub assemblies consisting of: two stub ball yokes; a stub ball yoke and a slip stub shaft; a stub ball yoke and a midship stub shaft; a stub ball yoke and a ball head.

Fig. 2. Propeller shaft sub-assembly equipped with two stub ball yokes.

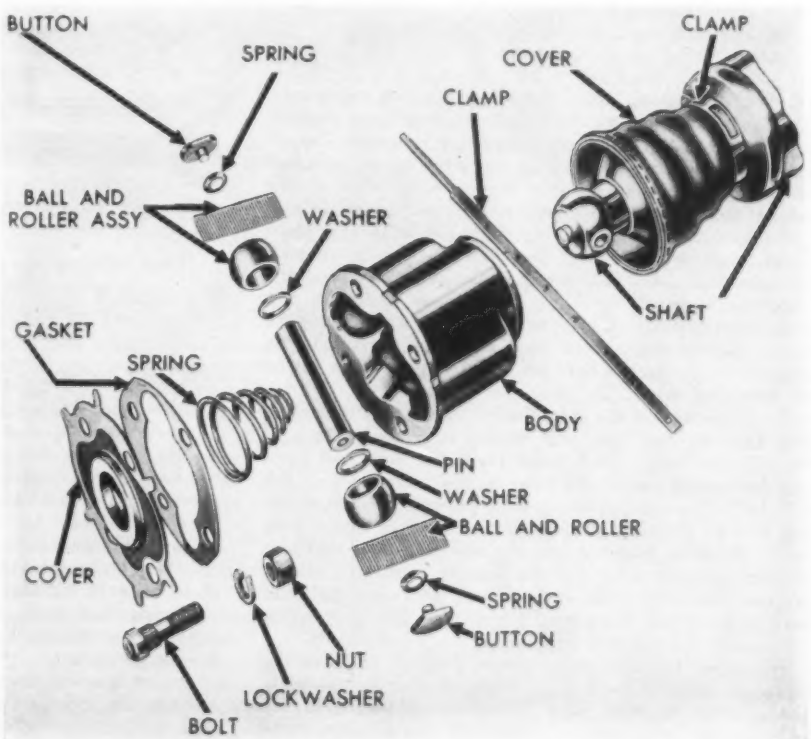
REPLACING STUB BALL YOKE

(Applies to any size Spicer, Blood, Cleveland, Detroit and Mechanics shaft sub-assembly with two stub ball yokes Fig. 2.)

After all end fittings have been removed from the

(Continued on following page)

Fig. 1. Ball type universal joint which is sometimes teamed with a cross-and-yoke universal on the same car.



By BEN IKERT
Editor

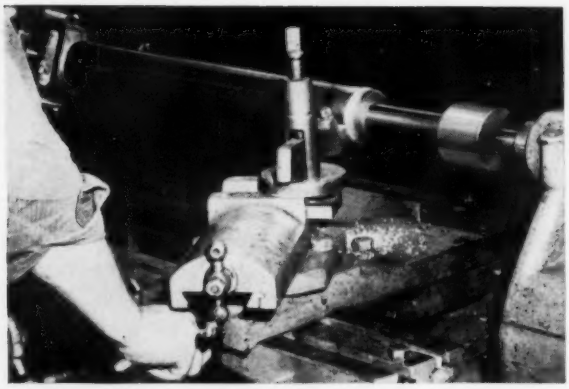


Fig. 3. To facilitate stub ball removal a V is cut at the point of weld in a lathe.

Servicing U-Joints . . . CONTINUED

assembly to be repaired, the proper end yoke is selected and assembled to the shaft at the stub ball yoke end with a "shop" set of journal and bearings. The correct collet adapter is put in the lathe chuck and centered for trueness, the compound carriage being moved to the tailstock end.

Mount the assembly in the lathe, placing the end yoke fixture that has been assembled to the shaft into the collet in the chuck. Next tighten the collet cap screw. Place the steadyrest on the latheways as near as possible to the weld of the stub ball yoke being replaced. Cut off the weld flush with the outside diameter at the stub ball yoke being replaced. Make a V-cut in the tube at the point of the weld to a depth of approximately 1/16", Fig. 3.

Remove the shaft assembly from the lathe and place the cut section on a steel block on the bench, striking the tube with a brass hammer while you're rotating the tube. This expands the tube so the stub ball yoke can easily be removed. After removing the stub ball yoke clamp the assembly in a vise and with a rotary file chucked in an electric drill remove the flash from inside the tube, Fig. 4.

Heat the end of the tube with a torch to a dark red. This expands the tube and allows easy assembling of the stub ball yoke. Next, hand press the stub ball yoke into the heated end of the tube until the shoulder of the stub ball seats against the end of the tube. While doing this, line up the lugs of both stub ball yokes so the lugs are in the same plane. Allow the assembly to cool three or four minutes and dip the heated end into water. Remove the end yoke fixture and shop journal and bearing kit which were used for driving the shaft while cutting off the old stub ball yoke.

Assemble the end yoke fixture, journal and bearing kit to the stub ball yoke being replaced. Put the assembly in the lathe, the end yoke fixture being placed in the collet in the lathe chuck. Next, buff the tube in three places, at each end and in the middle. Adjust the lathe steadyrest to a near zero reading (.003" is OK) using a dial indicator. Move the indicator to the buffed area at the end being repaired and check for run-out. A total run-out of .005" is permissible. If this limit is exceeded, tap the tube lightly on the high side until the permissible tolerance is reached.

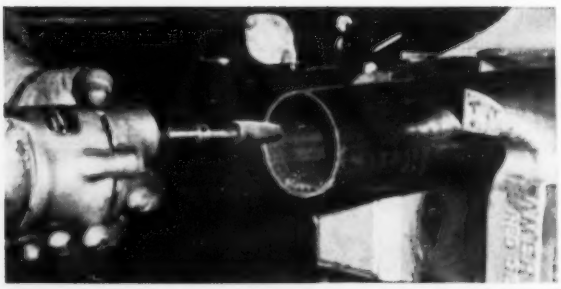


Fig. 4. For parts to fit accurately, the flash inside the drive shaft tube must be removed with a rotary file.

Remove the shaft from the lathe and place the shaft in two V-blocks on the welding table. Then, tack weld in four evenly spaced spots around the tube. Put the assembly back in the lathe and indicate for run-out again to see if the limits are still held. Mark the high side with a piece of chalk. Remove the shaft from the lathe, place it in the welding table V-blocks and starting with the high side, weld all around the tube.

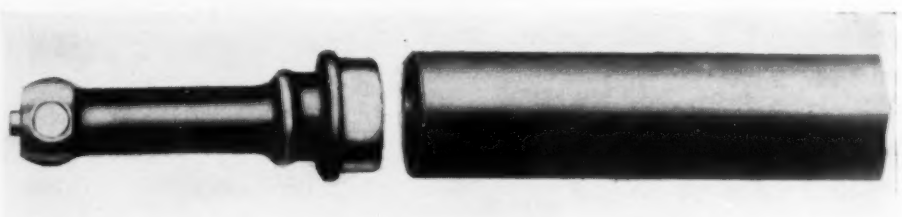


Fig. 5. Ball head (ball type) after removal from the propeller shaft tube.

Fig. 6. Type of permanent joint and shaft assembly.

After welding, check the shaft for run-out and if it requires straightening, follow the procedure given on page 51, January 1958 issue of AUTOMOTIVE SERVICE DIGEST.

REPLACING BALLHEAD (BALL TYPE)

After checking all parts for wear and operating condition, remove all end fittings and ballhead pins. The undamaged end, between the ball and the shoulder of the ball, is chucked in the lathe and the lathe carriage moved to the tail stock end. The steadyrest is set up between the carriage and headstock about 6" from the weld on the shoulder of the ballhead.

After buffing, taking indicator readings, cutting V at point of weld, expanding end of tube with hammer and removing flash from inside of the tube, as previously described with stub ball yoke construction, use the following procedure.

Insert a wood dowel pin in the pin hole of the ballhead in the tube and one in the new ballhead being installed. Heat the end of the tube to a dark red, to expand

it for easy assembling of the ballhead. Insert the new ballhead in the heated end and press it in to the shoulder of the ballhead. While doing this, line up the dowel pins by eye, so the finally installed pins will be in the same plane. Cool the assembly for a few minutes, remove the dowel pins and dip the heated end in water to cool the tube completely.

Remove the steadyrest from the lathe and with correct female tapers in the collet and tailstock, put the assembly back in the lathe (non-directional). Push up the tailstock and tighten the collet cap screw. With a table indicator, indicate at a maximum of .005″ at each end and .020″ in the center of the tube. Tap tube at the end being repaired until these tolerances are met. Welding,

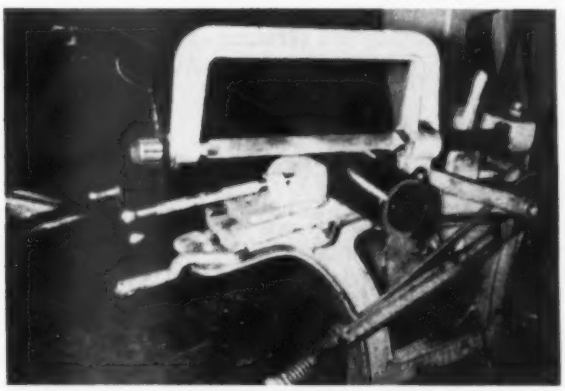


Fig. 8. Cutting propeller shaft tubing to correct length in a power cut-off saw.

checking for run-out and straightening operations follow as described for other assemblies.

TUBE REPLACEMENT

A typical permanent joint and shaft assembly is shown in Fig. 6. Replacement procedure is practically the same as for previously described types. When placing the assembly in the lathe, the end yoke fixture that has been assembled to the shaft goes into the collet in the chuck. The tail stock is pushed up to the center in the stub shaft.

After cutting off the stub shaft at the point of weld by turning off the old weld flush with the tube and making a 1/16″ V-cut at point of weld, move the lathe tool to the chuck end.

Turn off the old weld at the yoke end flush with the tube diameter and make a 1/16″ V-cut in the tube at the point of weld, Fig. 7. After the parts have been removed from the old tube, they are reassembled into a piece of new tubing which has previously been cut to correct length. It is important that the lugs of the sleeve yoke line up with the lugs of the stub-ball yoke to eliminate the possibility of propeller shaft vibration.

Referring back to the new propeller shaft tubing in the previous paragraph, manufacturers of U-joints stress the importance of using special propeller shaft tubing. Such tubing has greater elasticity and will take overload twist and return to normal. The propeller shaft is a critical part of the drive train and must transmit full engine torque.

After lining up the yokes, reassemble end yoke fixture to the shaft with the shop set of journal and bearings. Put the tube assembly back in the lathe, with the end yoke at the chuck. Loosen collet adapter cap screw, turn assembly by hand and check for run-out, the latter not to exceed .005″ at the ends and .020″ in the center. Tap

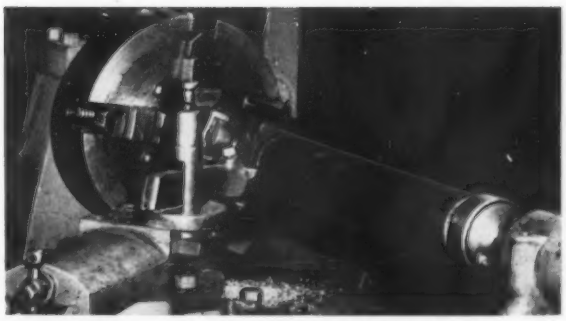


Fig. 7. Making a V cut at the point of weld on the yoke end of the tube of a permanent joint and shaft assembly.

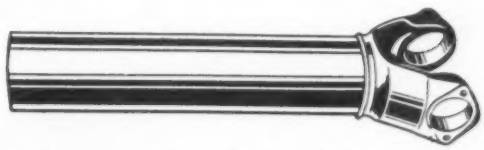


Fig. 9. Yoke and tube assembly. As explained in the text, only the end at the chuck in the lathe need be marked for run-out when this assembly is built up with a stub ball yoke.

high side of tube if necesary to obtain these limits.

Using the same procedure as with other assemblies, electric arc weld each end, check again for run-out and straighten. Reassemble previously removed end fittings to the shaft, replacing any of the old worn parts as required.

When rebuilding a shaft assembly using a new stub ball yoke, tube assembly, and ball yoke, as in Fig. 2, the first step is cutting the tube to correct length, Fig. 8. Following this, the shop technique is practically the same as with all other assemblies previously described. When indicating the assembly the steadyrest is adjusted to indicate .000″ to .005″ reading and readings must be held to a total maximum tolerance of .005″ at both ends and .020″ in the center of the tube.

Since this assembly, Fig 2, has been constructed from a yoke and tube assembly, only the end at the lathe chuck need be marked for run-out. If the shaft does not run true, mark the high side at the new ball yoke end and tap with a soft hammer until the shaft runs within limits. After welding, rechecking for run-out and straightening, the shaft is taken out of lathe, the end yoke fixture, journal and bearing assemblies also being removed.

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Automatic transmissions

A complete series of articles covering automatic transmissions — their design . . . how they operate, and how they are serviced. Be sure to read and keep all future articles for ready reference.

BY HERB CARRIER
Detroit Editor

Part VII—Servicing the Dynaflow

• A FEW YEARS AGO, the terror of the sand lots was a pitcher who had the uncanny ability to throw a baseball equally well with either hand. To bewildered opposing hitters he was known respectfully as "Shifty Gears."

Frantic managers, seeing their best men go down swinging could be heard to holler, "Be careful! Watch that guy. He'll *switch the pitch.*"

Buick's Dynaflow transmission also has the rare ability to *switch the pitch* through a unique feature built into their variable pitch stator assembly. Under certain conditions, changing the angle of the stator blades gives Dynaflow outstanding operational flexibility.

Variable pitch Dynaflow consists of a torque converter, a direct drive clutch assembly, a planetary gear set, and a complete hydraulic control system.

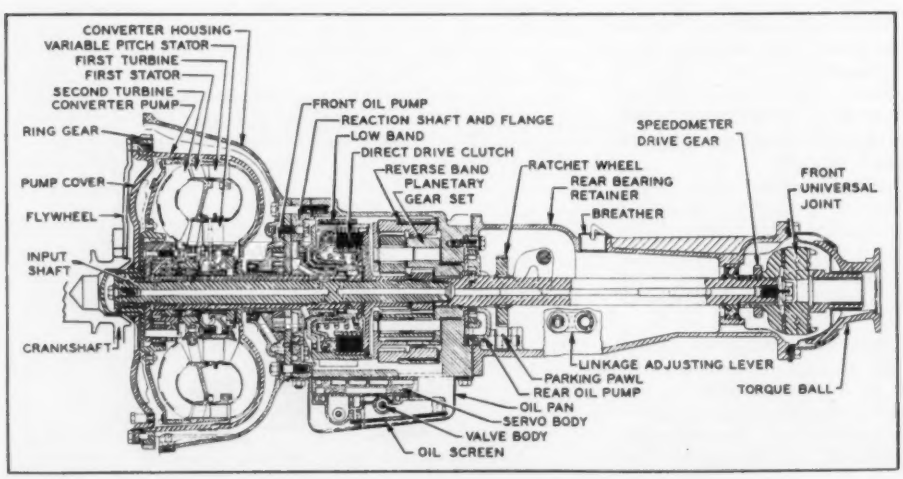
The torque converter consists of a primary pump, a first turbine, a variable pitch stator assembly, a first stator and sprag assembly, a sun gear and sprag assembly, a second turbine and carrier assembly, a disk and hub, and, finally, a pump cover. The unit is leak tight, and operates when filled with automatic transmission fluid.

CONVERTER OPERATION

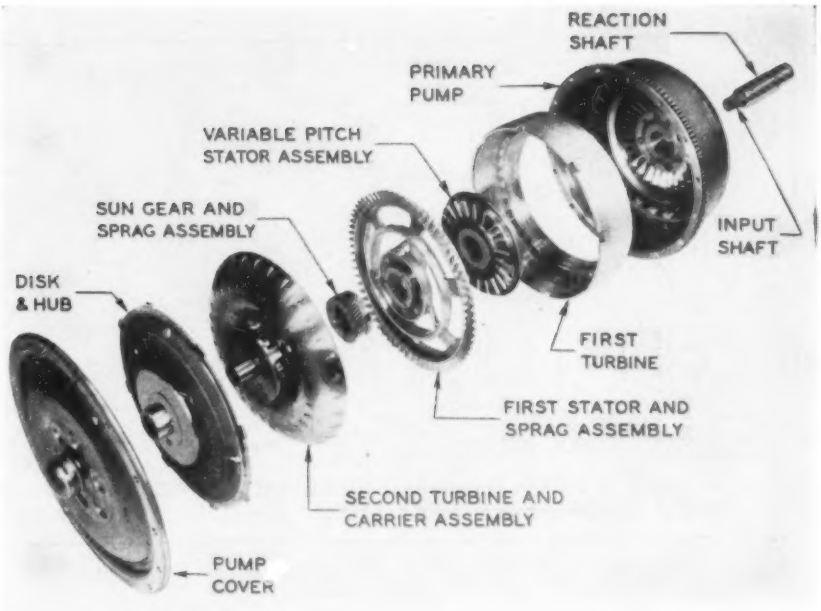
The converter pump is connected to the engine, and rotates whenever the engine is running. At idle r.p.m. oil is discharged from the pump at about parallel to its axis of rotation, and in the form of a spinning hollow cylinder. The oil is projected directly into the first turbine. Leaving the turbine vanes, the oil is then directed backward into the first stator. In its locked position (not free-wheeling), the stator redirects the oil to the second turbine in the same direction as pump rotation.

Leaving the second turbine, the oil "spins backwards" as it flows into the variable pitch stator. Again, when this stator is in its locked position (not free-wheeling) oil flow is redirected and enters the pump in the same direction as pump rotation. At idle speed, oil force is not sufficient to move either turbine.

As engine speed increases, pump discharged oil

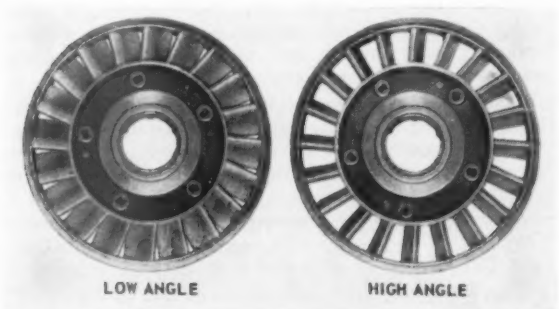


Detailed drawing of Buick's Variable Pitch Dynaflow transmission.



Exploded view of the torque converter, showing relationship of the major components.

assumes a high rotary speed. The whirling oil mass may be likened to the rim of a spinning wheel. Through converter design, this high pressure oil is directed to the first turbine. The turbine absorbs part of the energy transmitted by the oil stream, causing the ring gear in its hub to rotate the plant pinions. The pinions "walk around" the stationary sun gear so that the turning force is applied to the turbine carrier.



The variable pitch stator has twenty individual stator blades, each mounted on a separate control crank, and automatically controlled by a hydraulic piston in the carrier to give economical cruising (low angle), or high performance (high angle).

Oil leaving the first turbine strikes the first stator on the front side of the stator vanes. This exerts a pressure on the sprag clutch, and causes it to lock the stator in one position. Oil from the first stator is redirected into the second turbine causing it to spin in the same direction as pump rotation.

Further increase in engine speed causes a change of angle of oil leaving the first turbine. This, in turn, results in discharged oil striking the rear face of the first stator blades. Pressure on this side of the stator is not opposed by the sprag clutch; hence the stator is free to rotate in the whirling oil mass. Under this condition, oil is free to flow from the first turbine directly into the second turbine, which rotates and imparts torque to the turbine carrier. The turbine carrier transmits the torque of both turbines directly to the transmission input shaft.

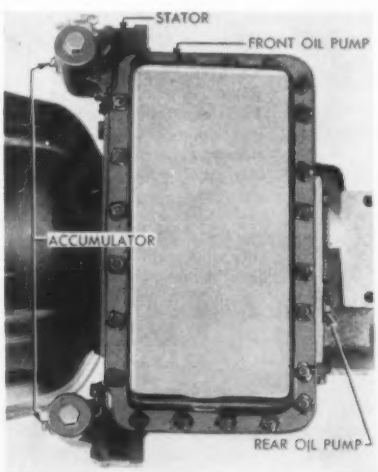
As the vehicle approaches cruising speed, torque multiplication automatically tapers off as the centrifugal force of the rotating oil mass in the turbines tends to counteract the flow of oil from the pump. Reduction of oil flow and pump output results in a decrease of torque multiplication as turbine speed increases.

At full cruising speed, the first turbine ceases to be effective, and the variable pitch stator free-wheels at sufficient speed so as not to interfere with oil flow between the second turbine and the pump. Now, the converter acts as an efficient fluid coupling, and transmits engine torque to the transmission at a 1 to 1 ratio.

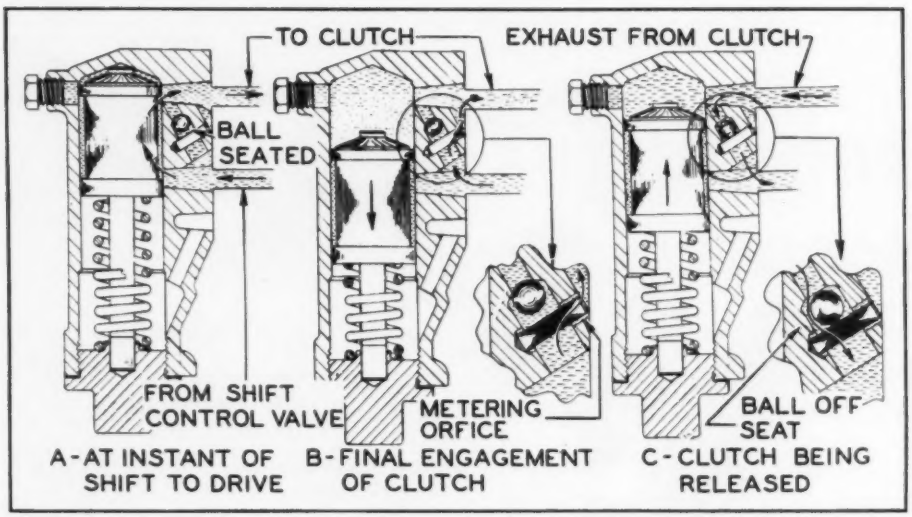
SWITCHING PITCH

So far the variable pitch stator vanes have remained in the low angle. However, at wide open throttle, when-

(Continued on following page)



Two accumulators — one for high range, and one for low range — are used to assure smooth transmission operation. They are very similar in appearance, differing only in internal construction. The high accumulator employs a check ball to control filling; low accumulator uses a drilled orifice.



The high accumulator piston is held at the top of the cylinder by a coil spring. At the instant of shift to drive, a large volume of oil flows around the piston to the clutch apply chamber. When the chamber is filled, oil back pressure overcomes spring pressure and forces the piston downward to allow final clutch application. Oil, in passing through the orifice surrounding check ball retaining pin, builds up pressure to assure solid clutch engagement. Shifting out of direct drive, the check ball is lifted off its seat so pressure can escape rapidly through channel.

Automatic Transmissions . . . CONTINUED

ever the transmission is in DRIVE range, the variable pitch stator will automatically shift to high angle, or *performance* position.

Each of the twenty stator vanes is mounted on an individual control crank which is supported at its outer end by the carrier ring and is free to turn in the stator carrier.

A piston, located in the carrier, actuates all stator blades simultaneously through the control cranks. For normal cruising operation in the DRIVE range, best performance is obtained at low angle. For powerful acceleration, high angle gives increased torque.

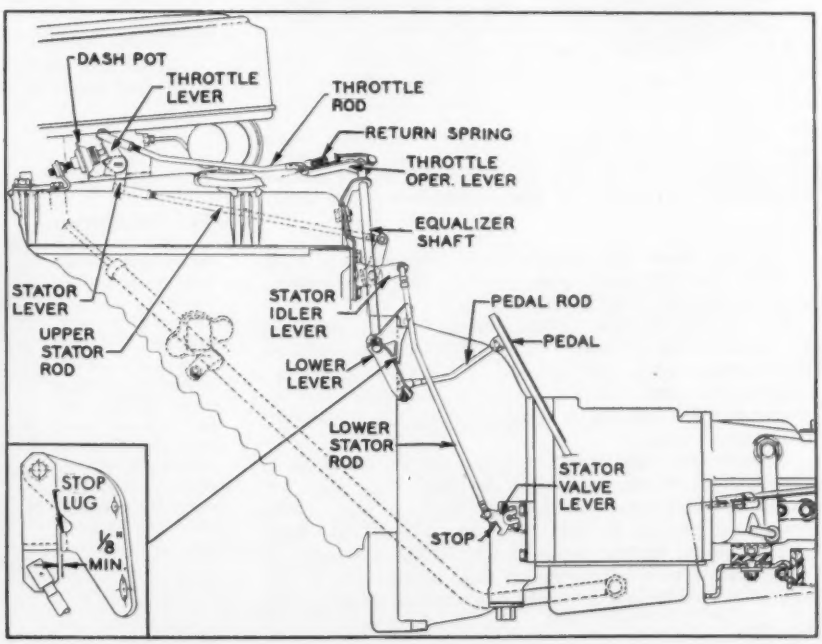
The piston is hydraulically controlled, and is so designed that the variable pitch stator will shift into high angle *only* when the transmission is in the **direct drive range.**

The planetary assembly used with Variable Pitch Dynaflow consists of a planet carrier, three low planet pinions, three reverse planet pinions, a reverse sun gear and input shaft, a reverse ring gear, a low and a reverse band, a low range reaction gear, and a high and a low drum. The reverse sun gear is splined to the rear end of the input shaft. The transmission output shaft is splined to the plant carrier.

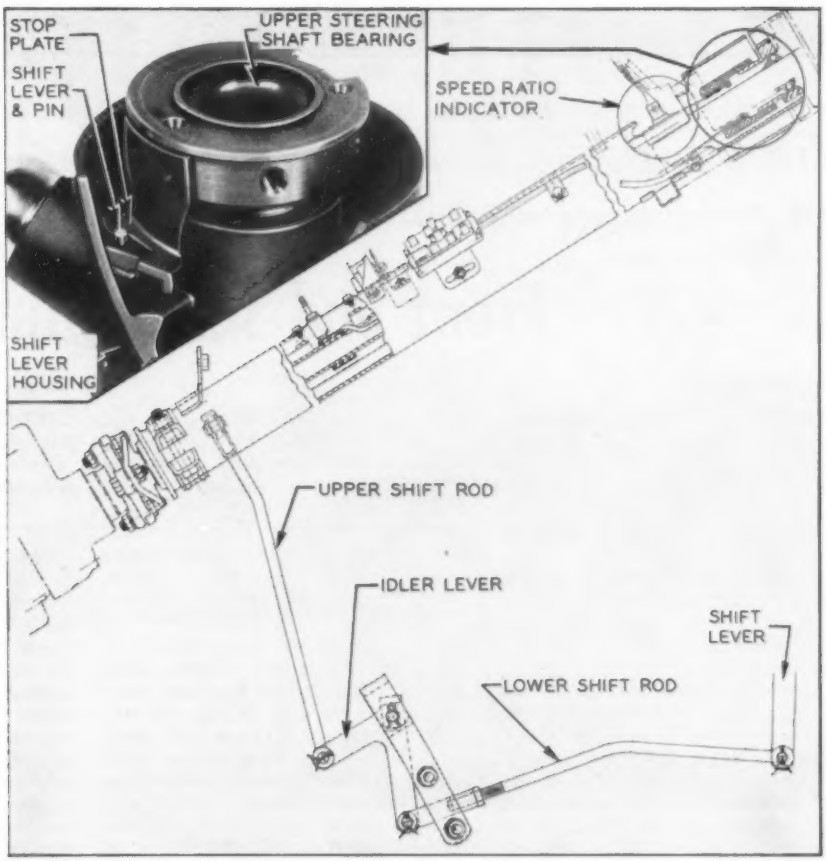
DIRECT DRIVE CLUTCH

The direct drive clutch assembly contains a clutch hub, six *internal* splined clutch plates, six *external* splined clutch plates, a low range reaction gear, a high and low drum, a clutch piston, and a clutch spring.

The internal splined clutch plates are coated with a friction facing. The external splined plates are uncoated steel. The plates are arranged alternately so that when they are pressed together by hydraulic pressure on the



Throttle linkage and stator control linkage of Variable Pitch Dynaflow. Inset shows minimum clearance between equalizer shaft lower lever and stop lug on the shaft-to-cowl mounting bracket. This clearance is very important, and must be accurate.



Shift control linkage operation should be carefully checked before adjustment is attempted. The shift control lever operates a tubular control shaft located inside the column jacket. When the lever is pulled upward, the lever stop pin is disengaged from a stop plate in the shift lever housing. The control shaft can then be rotated by moving control lever.

clutch piston, they lock the low range reaction gear to the input shaft.

SHIFT PATTERN

In **direct drive,** the input shaft and the output shaft are solidly coupled so that they turn as an assembly without any gear action. This action is obtained by applying the clutch, and releasing both low and high bands.

In **low range** the output shaft turns in the same direction as the input shaft but at a reduced rate of speed. This is accomplished by placing the planetary assembly in reduction by applying the low band to hold the low drum stationary. In **low range,** the overall maximum torque multiplication is 5.82 to 1.

Reverse range is accomplished by having the output shaft turn in a direction opposite to that of the input shaft. To do this, the reverse band is applied to hold the reverse ring gear stationary. A speed reduction of 1.82 to 1 combined with a maximum torque multiplication of 3.2 to 1 through the torque converter results in an overall possible starting torque of 5.82 to 1 in reverse.

In NEUTRAL neither band nor the clutch is applied. The gears are allowed to spin freely without transmitting engine torque to the transmission.

In PARK, a locking ratchet wheel on the transmission output shaft is engaged by a locking pawl mounted on the transmission rear bearing retainer to secure a firm mechanical lock for the rear wheels.

The shift sequence chart is as follows:

Drive—Clutch applied Both bands released	**Neutral**—No bands No clutch
Low—Low band applied Clutch and reverse band released	**Reverse**—Reverse band applied Low band released
Park—Park mechanism engaged	Clutch released

ACCUMULATOR OPERATION

Dynaflow uses cushioning devices called accumulators to insure rapid, smooth engagement of the direct drive clutch and the low band. The function of the high accumulator is to allow a large flow of oil into the clutch apply chamber until the clutch just starts to engage. Then the oil flow is slowed down by the accumulator to prevent sudden, harsh clutch engagement.

The low accumulator operates in an identical manner to control the flow of low servo apply oil.

Mechanically, the high and low accumulators differ only in that a check ball is used in the high accumulator to control the rate of clutch filling, while a drilled orifice (.0625") is used in the low accumulator to control the rate of servo filling. Outwardly the accumulators appear almost identical.

SERVICE ADJUSTMENTS

In-vehicle service adjustments of the Variable Pitch Dynaflow include only linkage adjustments. Band adjustment usually requires transmission removal because

(Continued on page 76)

The original steering ease and driving comfort designed and built into a car can fade so gradually that the car owner is often unaware that something is wrong. Whenever the opportunity arises, every shopman should use his . . .

Front end service fundamentals

By FRANK WEST

• WHEEL ALIGNMENT is probably the most neglected of any phase of automotive service; due to the fact that the automobile will run, even though it may pull to the right, steer hard or tend to wander on the highway.

One group of car owners gradually become accustomed to these defects and learn to control them; not realizing, in many cases, that the front end is not behaving as it should. These are the motorists where it is up to you, the shopman, to call attention to the fact that service is needed; and in most cases the needed front end service can be sold.

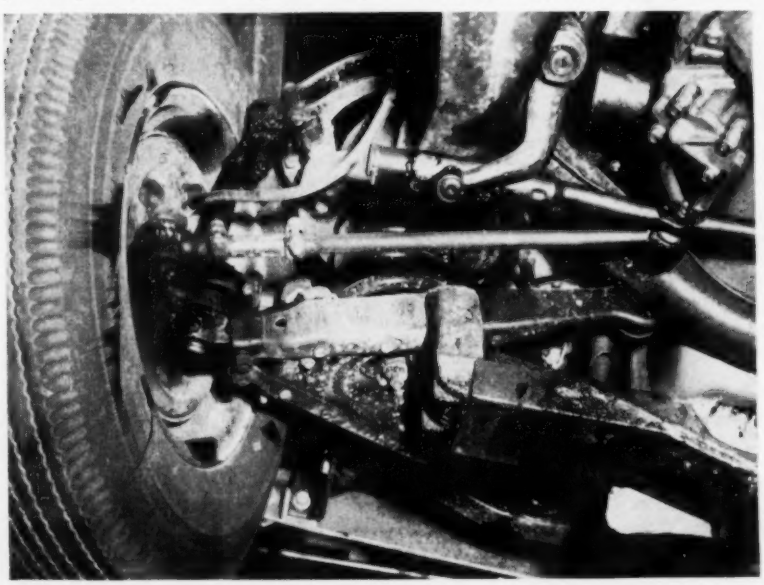
On the other hand, there are drivers more sensitive to the "feel" of an automobile on the road, and these car owners will usually take their cars to a shop for a suspension service job when the above mentioned symptoms rear their ugly head.

The signs that indicate the need for front end service can be observed by any alert mechanic who is working on a car *if he will look for them.* He will not necessarily know how to correct the trouble, but he will know it is there and can call the car owner's attention to it.

LOOK TO THE TIRES FOR CLUES

The most obvious indication is unusual wear on the front tires. Loose wheel bearings, worn king-pin bearings and badly worn tie-rod ends will cause cupping and unequal wear around the tread. Spotty wear indicates a general looseness of the front end. Incorrect camber setting will cause a tire to wear off on one side of the tread. A combination of low air pressure and camber and toe-in error will cause rapid wear all over the tread, with excessive wear on the sides of the tread. Misalignment and unbalance will cause wear and excessive cupping at certain spots on the tread. Wrong toe-in will cause excessive side drag or scuffing and will often show a feather edge at the corners of the tread design.

Worm's eye view of a modern suspension system, showing the lower control arm, ball joint suspension, left tie rod, pitman arm, etc. Note toe-in adjustment on the tie rod.



EIGHT FACTORS INVOLVED

There are eight wheel alignment factors that must be correct and properly coordinated on a car if it is to steer, track and hold the road as it should. These are: (1) Caster; (2) Camber; (3) Toe-In; (4) King pin inclination; (5) Turning angle or toe-out on turns; (6) Tracking; (7) Steering control alignment, and (8) Wheel balance. Some authorities consider only the first five of these factors as relating to steering geometry, but the last three do affect roadability of the car and tire wear, so they should not be overlooked.

Before going deeper into front end service, the meaning and significance of the eight factors should be thoroughly understood.

Caster: Positive caster means the angle of the king pin leaning backward with the top tipping toward the rear of the car. Negative caster is the angle leaning forward. Where the ball joint suspension has replaced the king pin, the caster angle refers to the steering axis instead of the king pin. This would be the angle made by a line joining the center of the top ball joint with the center of the bottom ball joint, which is the geometrical equivalent of the king pin. The purpose of caster is to cause the front wheels to run straight ahead normally, and to reduce steering effort.

Camber: Positive camber is the angle of the wheels leaning outward so that the two front wheels are farther apart at the top than at the bottom. Negative camber is the reverse, with the wheels leaning slightly inward so that the tops of the wheels are closer together than the bottoms. The purpose of camber is to bring the center of the tire tread which is in contact with the road more nearly under the point of load. Some racing cars often have

Tire wear resulting from misalignment of the front wheels: Left: Faulty camber concentrates tire wear on one side of the tread. Center: Excessive toe-out develops sharp edges toward the *outside* of the car; while excessive toe-in develops sharp edges toward the *inside* of the car, as shown on the right.

negative camber to give somewhat more stability on turns.

Toe-In: Toe-in is the drawing together of the front wheels at the front so that the wheels, instead of pointing directly straight ahead, point slightly inward. The purpose is to prevent excessive tire wear and to insure proper steering on the straight-away. It also allows for the slight springing of the steering linkage from the road friction of the tires and normal slight play or give in the tie-rod joints.

King Pin (or steering axis) **Inclination:** King pin inclination is the angle of the king pin leaning inward toward the center of the car with the top of the king pin or ball joint suspension nearer to the center of the car than the bottom. The purpose is to reduce the need for camber, to help the car to steer straight and to help return the steering wheel to the straight ahead position after a turn.

Toe-Out-On-Turns: This is variously referred to as turning angle, steering radius or steering geometry, though toe-out-on-turns is the most descriptive name. This is the relationship of the steering arms and front wheels on turns, which causes both front wheels to roll without side scuffing on turns. Its purpose is to allow the front wheels to turn about a common center when the car makes a turn, so each wheel will have pure rolling motion even though the inner wheel is, in effect, ahead of the outer on turns.

Tracking: Tracking means that the rear wheels should follow the front wheels in a parallel position. Tracking is necessary for the easiest steering and to minimize tire wear. A swayed or diamond frame, or a swung rear end will cause poor tracking and unsatisfactory road performance of the car.

Steering Control Alignment: This is the proper adjustment of the connecting linkage between the steering mechanism mounted on the frame and the tie-rod, with the wheels in the straight ahead position and the steering gear set on the high spot.

A broken sway bar or stabilizer that caused unpleasant front end sway until it was spotted by an observant lube man and reported to the owner.

Wheel Balance: Static balance is a condition that exists when the weight of a wheel assembly is so distributed on its own spindle or shaft that the wheel will remain at rest when stopped in any position. Dynamic balance is a condition independent of static, that exists when the weight of a revolving wheel is so distributed that no vibration is present regardless of the speed of wheel rotation.

POINTERS ABOUT CASTER

The caster angle is the most important of all the angles involved in steering geometry; as it has most to do with car safety and good or bad car handling. It is the weight factor in alignment. A lot of revisions in caster specifications have been made by the car manufacturers in order to get the best settings for their cars. Some of the specifications allow a wide tolerance in the amount of caster, to cover the various operating conditions the car will encounter in service. The range of allowable caster will vary from ½° to as much as 2°.

The amount of caster to give to a knee-action car depends upon the type of driver, on whether the car will be used exclusively in the city or whether it will be used for both city and country driving, on what kind of roads the car will be driven, on how much load the car will usually carry, and on the size and type of car.

The car will steer easiest at zero or slightly negative caster. The more positive caster given any car the greater will be the steering effort required to make it turn a corner. This does not mean that all cars should be set at zero; other conditions enter into the picture. If the car is to be driven exclusively in the city where speeds are low and there are many corners to be turned, the caster should be small positive or slightly negative. This is particularly true if the car is a heavy model or the driver a woman.

Some knee-action cars are designed for positive caster and some for negative, but high speed driving on the highways should have more caster—either positive or negative, as specified—than is needed for city driving.

The rear axle torque at high speeds will raise the front end of the car and lower the rear end. This will cause

(Continued on following page)

an increase in positive caster or a decrease in negative caster from that shown by the setting gauges when the car is stationary. Another consideration is geography, for western driving is different from most eastern driving. In the wide open spaces out west, generally the wind is higher, distances are greater and there are some rough roads. Experienced alignment men working on these cars believe in plenty of caster.

This does not mean the specifications should be ignored but such factors act as a guide as to which way to make the setting within the specified tolerance. In general the caster on the right and left wheels should be as nearly equal as possible, with never more than ⅛° difference at the most.

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If the caster is not equal on both sides, the car will always pull to the low side of positive caster and to the high side of negative caster. Caster pull will always be in proportion to the weight on the front wheels at any given time. This load will increase when the brakes are applied or the engine is being pushed by the rear wheels, and will be decreased when power is applied to the rear wheels and the front end raises up slightly due to rear axle torque.

Since caster is so important, great care should be used when checking or setting it. The alignment machine must be kept level. A one inch difference in height between the front end and back end will change the caster reading about ½° on the average car. Keep the ball-bearing turning plates clean and easy turning. Turn the wheels through the exact angle each way for which the caster gauge was designed—15°, 25°, etc. Take hair line readings, looking squarely at the caster gauge dial. By observing these precautions, precision readings and settings can be obtained. Caster errors are often cumulative and can add up to as much as 1° of error, which is enough to spoil an otherwise good job. Knee-action cars are not troubled by low speed shimmy induced by wrong caster settings as used to be the case every once in a while with the old type one piece axle with semi-eliptic springs. If there is a case of low speed shimmy on a knee action car it will not be because of the caster setting but from some other cause or causes.

SOME CAMBER CONSIDERATIONS

It is not generally recognized, but it is true that the camber changes with every variation in the angle of the control arms on knee action front end suspension. The reason for this will be apparent on examination of the camber diagram. It is quite necessary that the front wheel tread be maintained constant; otherwise there would be serious scuffing of the front tires. Therefore, since the upper control arm is made shorter than the lower control arm, when the front spring on either wheel is compressed due to loading or road irregularities, the upper side of the wheel will swing inward as the bottom of the wheel rises straight up to maintain a constant tread width.

With a lone driver in the car, all the load will be on the left side and the left wheel camber will change which may make the car pull to the left, especially if the camber is set slightly higher on the left side, and when driven at low speed around town. A customer usually does not complain about a slight pull to the left in city driving, and more frequently there will be one or more passengers in the car. If more camber is put on the right wheel, there is more likely to be complaints about the car pulling to the right with a passenger in it. The car will not pull to the left at highway speeds when the driver is alone, so on a car which is mostly driven by one person without passengers, it may be better to allow a little more camber on the left wheel.

Engine torque is such a variable factor that usually you cannot set the camber to definitely compensate for

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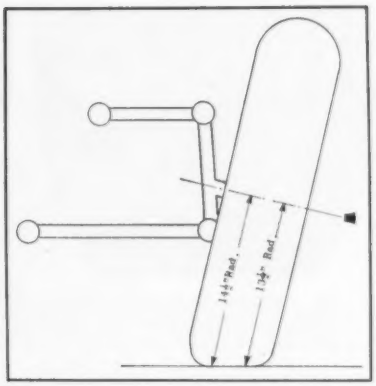
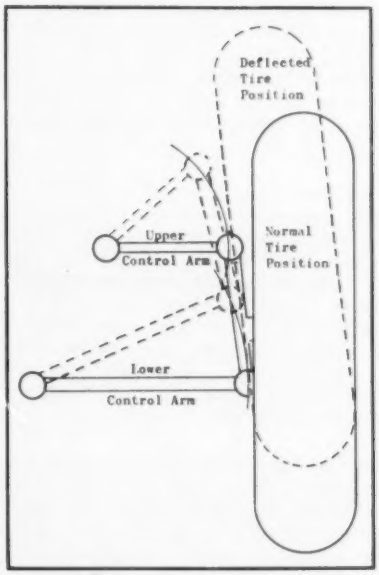
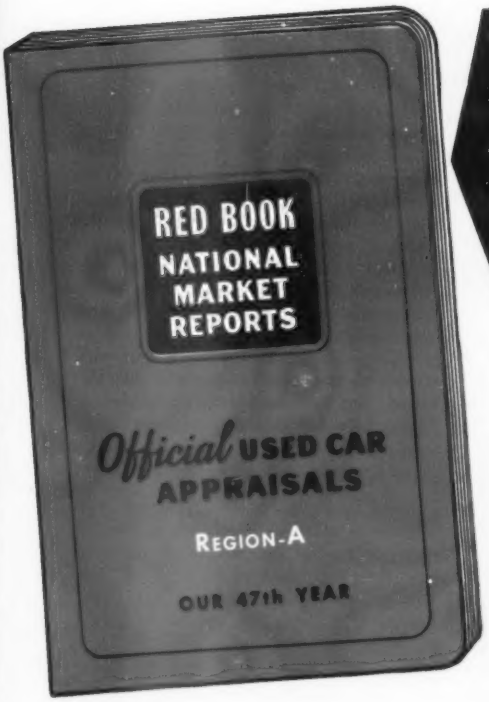


How too much camber causes tire tread wear. Different radii at the inner and outer portions of the tire pattern on the road causes slippage on the outer portion with resulting wear. The camber is exaggerated, but the effect is as shown when the camber angle is too great.



How camber changes with front spring deflection. The control arms are so proportioned that the bottom of the tire moves straight up and down with road irregularities to maintain constant tread distance on the road surface.



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it; only for what is assumed to be an average value. If the car drives well at cruising speed on the level, although at full power going up a steep hill it may pull to the right, the setting is good. It may also pull to the left when the engine is used as a brake and the engine torque is applied in the reverse direction.

In addition to engine torque we have torque reaction from the rear axle. This reaction may be from 300 to 1200 foot pounds, and will cause a lift at the front end of the car of 30 to 120 pounds, which will be transferred to the rear wheels. At high speeds on the highway this lifting of the front end will cause a decrease of camber on the front wheels of knee action cars that will vary in amount from nothing to as much as ¼° on each wheel.

It will at once be recognized that the factors mentioned here should be carefully considered in wheel alignment work, though too often they are overlooked. Camber also affects tire wear. With the wheel tilted outward—positive camber—the effective diameter of the tire at the point toward the outside of the tire contact pattern on the road, will be somewhat less than the effective diameter at the inside point. Since all parts of the tire are turning the same number of revolutions per minute the portion of the tire with the smaller effective diameter will travel more slowly than the portion with the larger effective diameter. Therefore, as the two portions travel at different speeds while in contact with the road surface, there will be a scuffing action on the outer portion which will lead to rapid tire wear on the outer portion of the tread. This condition is readily identified on inspection of the front tires.

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KING PIN INCLINATION

King pin inclination causes the wheels to pivot near the center of the tire for easier steering and relieves the steering linkage of most of the strains from application of the front brakes. It makes the car tend to run in a straight ahead direction and causes the steering wheel to come back to straight ahead position by itself, after a turn.

King pin inclination is built into the front end when the car is made and no adjustments for it are provided. The angle of the king pin or steering axis and the wheel spindle is established so the center line of the king pin or steering axis will come fairly close, if extended, to the center of the tread pattern on the road surface. The included angle between the steering axis and the center line of the wheel spindle, minus 90°, minus the exact camber angle set by the factory, is the true king pin inclination.

Camber adjustment is made on late model cars by adding or removing shims which position the upper control arm. This moves the whole steering spindle or ball joint suspension, and also changes the king pin inclination. Decreasing camber causes a corresponding increase in king pin inclination, which helps to keep the car on a straight course.

The angle of king pin inclination can be checked with most of the better alignment gauges. If it does not add up correctly, the spindle is bent. A very simple check for a bent spindle is to run your fingers around the edge of the brake backing plate and the brake drum. If the space is not uniform, the spindle is bent and should be replaced.

One confusing thing about king pin angle is that some manufacturers give a wide tolerance for camber and no tolerance for king pin inclination. Others give different tolerance for the two angles, yet you cannot change one without changing the other. Therefore,

consider camber and let the king pin angle take care of itself except for checking it to detect a bent steering spindle or ball joint suspension.

TOE-IN

For many years it has been the opinion of many service men that toe-in was directly related to camber. This was based on the knowledge that a disk when tilted will roll in a circle, and the idea that an automobile wheel when tilted in its camber angle would tend to run in a circle if not given the correct amount of toe-in.

This is not so, because a tire runs with a vertical load consisting of part of the car's weight and this load flattens the tire against the road surface so that the part of the tire against the road is like a long rubber belt rather than like a non-flexible round wheel.

For maximum tire life and best results, toe-in should be zero at all times **while the car is running,** and to obtain zero toe-in we must consider the caster angle. Positive caster will cause the wheels to toe out. This condition is caused by the same law that makes a car pull to the side having the lowest positive caster or the side having the highest negative caster.

Another force that occurs while driving is the rolling resistance of the tire which tends to toe the wheels out slightly as the car is driven. This force is not as great as the caster effect and is variable according to the road and tire. However, on the average paved roads, the toe out effect is about the same as the toe-in effect of 1½° of positive caster.

If the car is running with a toe-in or toe-out force, the steering linkage must resist that force in order to maintain the proper toe-in alignment. Loose or weak steering system parts can cause the car to run with more or less toe-in than is shown on the alignment machine. Always check these parts, and if they are defective, they should be replaced.

TOE-OUT ON TURNS

Toe-out-on-turns is necessary because, when a car is turning, the front inner wheel, in effect, gets ahead of the outer wheel. This is true because the axle does not pivot and therefore the inner wheel on turns, remains in a position that is ahead of the position it would occupy if it was on an axle that pivots as wagon axles do. In order to give true rolling action with no sideslip the inner wheel must pivot on its king pin more than the outer wheel. This is accomplished by having the steering arms which control the position of the steering spindle, point toward the center of the rear axle instead of being parallel. If they were parallel the wheels would also remain parallel at all times regardless of how they were turned to guide the car. But with the steering arms not parallel, the inner wheel will always turn more, giving the required toe-out-on-turns.

The standard way to check this is to turn the outer front wheel 20°, with the two wheels mounted on turning plates. Then measure the amount the inner wheel has turned, which will be from 22° to 24°. The purpose of checking toe-out-on-turns is to see if the steering arms are bent, since there is no adjustment.

Tire wear from misalignment occurs at high speeds. High speed turns are made at much less than 20° and 22° to 24°, respectively, for outer and inner wheels. Actually, on a fairly sharp turn the front wheels are turned only 2° to 3° for the car to make the turn. The important adjustment is for toe-in rather than for toe-out-on-turns. If this latter angle shows error, either the steering arms must be straightened or replaced.

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Compact • Powerful • Handsome
These good-looking, fast-selling Lucas Twinlamps blend perfectly to give complete road coverage for any conditions. The clear lens unit concentrates piercing, 80,000 candle power beam into a far reaching pencil-thin ray for safer, fast night driving. The black-pattern lens unit produces a wide-spread, flat-topped beam with sharp cut-off that slices through the thickest fog. Heavily chrome plated. Easily mounted. Compact 6" diameter and shallow styling. Choice of amber or regular lens, 6 or 12 volt. Also available singly. Write for details on the complete line of Lucas products.
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Right from the start...
Right for replacement!

Servicing the self-adjusting Edsel brake

Only after brake shoes have been relined need the mechanic alter the star-wheel position that determines the correct lining-to-drum clearance.

• SERVICE WORK ON Edsel brakes follows the standard procedure for Bendix fixed-anchor type brakes. There is one exception to the standard Bendix design in this unit: the self-adjusting mechanism on each of the assemblies. The self-adjusting feature is to insure correct adjustment of the lining-to-drum clearance at all times.

Structural parts of the brake, for both front and rear wheels, include the cable, "A," equipped with an eye which hooks over the anchor pin, "B." From the anchor pin, the cable passes over guide "C" to the lever, "D." Both "C" and "D" clip to the secondary brake shoe. Spring "E" connects lever "D" to the primary brake shoe; spring "F" connects the primary and secondary shoes (see Fig. 1).

SELF ADJUSTMENT PROCEDURE

Self adjustment operates as follows: because of the wrap-around, or servo action, of the shoe assembly, when the brakes are applied and the car is driven in reverse the eye of the secondary brake shoe leaves the anchor pin. This causes the distance from the cable eye to lever "D" to increase, and thus the cable pulls the lever upwards around its pivot point. Upon release of brake pedal pressure, the lever returns to its normal position.

Cable "A" is of such a length that if there is more than the specified maximum lining-to-drum clearance (.010"), the lever pivots enough to catch the next tooth on the star wheel, "G," when returning to the original position. When the brakes release, then, the lever moves the star wheel one tooth, causing the brake shoes to expand and be pushed closer to the brake drum. This lever action takes place on every reverse brake application; but star wheel "G" is only moved if there is too much lining-to-drum clearance. When the adjustment is correct, the secondary shoe does not move far enough away from the anchor pin to allow the lever to catch the next tooth of the star wheel; therefore, no change in the adjustment is made.

ASSEMBLIES NOT INTERCHANGEABLE

Star wheel assemblies must never be interchanged from one side of the car to the other, because left-hand threads are used on the right-side brake assemblies, and right-hand threads on the left side. Obviously, reversing the star wheel assemblies would cause the shoes to retract.

So far as removal, repair and installation of drums and linings is concerned, general service on Edsel brakes is done substantially in the following manner, after wheels are off.

With the cotter pin and spindle nut removed, pull the hub and drum from the front wheel. Rear brakes are removed by unscrewing the Tinnerman nuts that hold them to the axle shaft flanges.

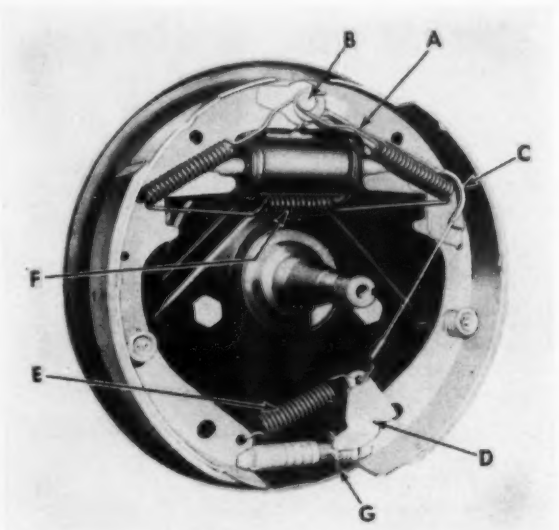

Fig. 1. Edsel brake detail: self-adjusting mechanism consists of cable A, the end of which hooks over anchor pin B; cable guide C; lever D, which at its lower end engages the star-wheel. (Photos courtesy Ammco Tools, Inc.)

On rear brakes, move the parking brake operating lever forward and lift out its cable. Next, remove the brake shoe retracting springs; self adjuster cable, lever and spring; anchor pin guideplate, cable guide and the brake shoe hold-down spring cups. The brake shoes can then be removed, and the wheel cylinder piston retaining clamps installed.

Brake drum examination follows. Heavy scores can be turned-out, provided that not more than .030" is removed from the drum wall; that is, the inside drum diameter cannot be increased by more than .060". The normal Edsel drum ID is 11.000", so that the maximum is 11.060". With that diameter, it is recommended that oversize linings or shoes-and-lining assemblies be used.

Linings should be replaced if the face has worn to within 1/32" or less from the rivet heads, and the relined shoes should be ground to an arc of .020" under the actual drum diameter, on a grinder adaptable to shoes of a fixed anchor type brake. Use a suitable lubricant (sparingly) where the brake shoe surfaces contact the backing plate. At this point, examine the hydraulic wheel

cylinders for evidence of fluid leakage, and if necessary, hone the cylinders.

To reassemble, place the shoe assembly in position on the backing plate and install the hold-down spring and cups. On the rear brakes, the parking brake strut and spring must be in position before reassembly. Install the cable guide, anchor pin guide plate and brake shoe retracting springs. The primary spring goes on first, then the cable eye and lastly, the spring of the secondary shoe. The parking brake is hooked into the brake shoe parking brake lever (on rear wheels).

Place the adjusting screw spring and screw in position, as well as lever "D" with the cable attached. When replacing the screw assembly in position between the brake shoes, make sure the adjusting screw will be opposite the slot in the backing plate. Adjustment is impossible if the installation is reversed. If the rear brake linings have been replaced, loosen the brake cable at the equalizer and install the drums.

BE SURE BEARING CONES SEAT PROPERLY

Install the front wheel hub and drum. Pack the outer bearing with wheel lubricant and install the bearing on the spindle. Install the washer and spindle nut, using a 12" wrench, while rotating the hub and drum assembly back and forth until there is a noticeable drag. This assures that the bearing cones are correctly seated, with rollers lined up and seated. Then back-off the spindle nut to line up the nearest slot with the hole in the spindle—about 1/6 to 1/4 turn. This should allow the drum to rotate freely with no perceptible end play. Lock in this position with the cotter key, and replace grease cap.

The brakes should require adjustment only after the shoes have been relined. Raise the car so that wheels are off the floor. Remove the dust cover from the access hole in the bottom of the backing plate. Then adjust star wheel to expand the brakes (hand movement downward) until a heavy drag is felt, or the wheel cannot be turned.

Fig. 2. Reconditioning the bore of a hydraulic brake wheel cylinder with a hone. Bore must be free of pits or rust spots and smoothly finished for good leakage-free piston action.

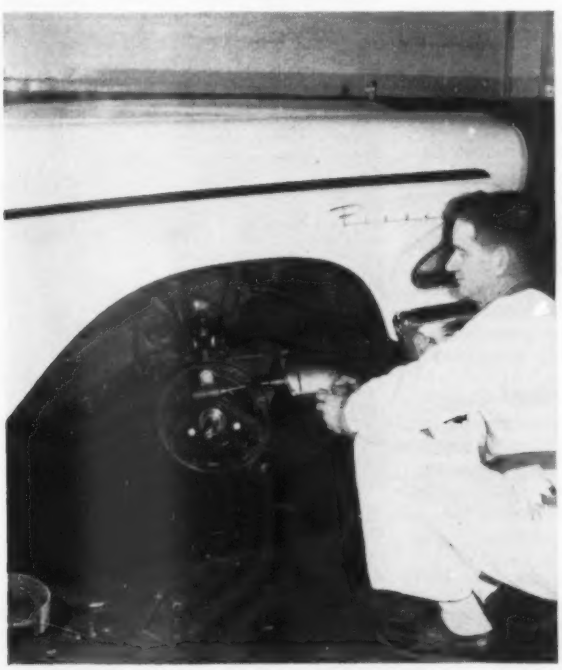

Fig. 3. It takes something like eight or ten times the power to stop a car going 70 mph than was required to get it up to that speed! That's why expert brake service specialists check and correct. This one is tightening an Edsel brake anchor.

Mark the star wheel with a dab of gearmarking compound or paint. Place a small screwdriver or an ice pick in the access hole, and push the self-adjusting lever away from the star wheel; then back the wheel off one complete turn (hand movement upward).

After brakes have been adjusted, the wheels are installed (wheel nuts torqued to 70-80 lbs. ft.) and the car is ready for final brake adjustment. It is driven in reverse and the brakes applied four or five times. This allows the self-adjustment mechanism to function and complete the brake job.

Ignition Timing the '58 Ford Cars

Ford Service points out that basic timing specifications have been changed slightly from earlier models. Current recommended settings (before T.D.C.) are as follows:

	Conventional and overdrive	Automatic transmission
6-cylinder	T.D.C.	2°
V-8 292 cu.in.	3°	6°
V-8 332 cu.in.	5°	8°
V-8 352 cu.in.	3°	6°

Minimum fuel grades (research method) are 88-octane for the six and the 292 V-8; 96-octane (premium) for the 332 and 352 engines. Distributor vacuum line should be disconnected, when setting timing, and idle speed should be below 550 r.p.m.

Note that the crankshaft damper on six-cylinder engines has five timing marks representing T.D.C., 3°, 5°, 7° and 9°. On V-8's, however, there are six marks indicating T.D.C., 2°, 4°, 6°, 8° and 10°.

Ignition cables on the new Interceptor V-8 must be correctly positioned in their supporting brackets so as to eliminate the adverse effects of "cross fire."

Say You Saw It In Automotive Service Digest

These are new *manufacturers' products*

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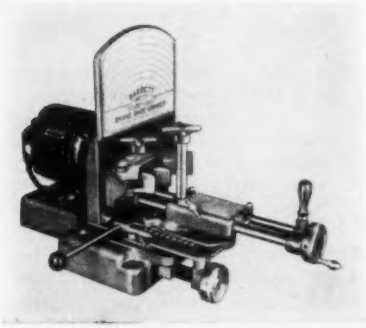
Radius Grinder Improved

Barrett Equipment Co. announces that their B-75B Radius Grinder is now being preset at the factory to automatically undersize grind brake



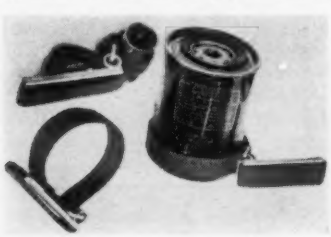
shoes to properly fit the brake drums in which they are to operate.

According to the manufacturer, even the most inexperienced mechanic can now undersize grind brake shoes for correct fit to drums with a Barrett Radius Grinder by: 1. Measuring drum diameter; 2. Setting grinder to drum diameter; and 3. Grinding shoes.

(Use Reply Card for Further Information)

Filter Grip Wrench

Grigg Specialty Tools announces a new tool for the safe removal and installation of screw-on type oil filters.



Unique feature of the tool is, the harder the pull, the tighter the grip.

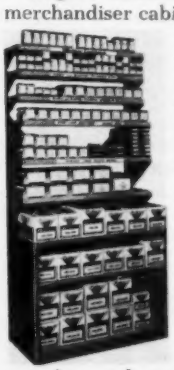
A wide flexible web strap prevents filter damage and assures non-slipping when removing hot, dirty or oily filters. In addition, the tool assures safety and tightness when installing new filters.

In addition to being used on filters, the tool can also be used as a holding or turning tool for other purposes, accommodating articles one to eight inches in diameter.

(Use Reply Card for Further Information)

Brake Parts Merchandiser

Wagner Electric announces a new merchandiser cabinet for stocking and displaying their various brake product assortments. A choice of four balanced product assortments are offered—the choice dependent on the type or amount of brake work performed.



The basic assortment consists of fluid, cylinders, hose, stoplight switches and repair kits for popular model vehicles. Other assortments include exchange shoe sets, with coverage extended to include wider vehicle model application.

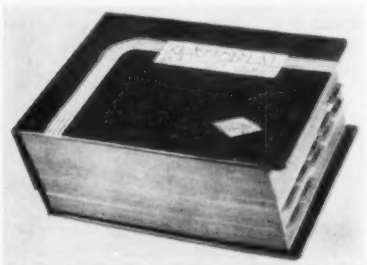
(Use Reply Card for Further Information)

Auto Repair Manual

Service information on the 1958 model American automobiles is now off the press and being distributed to National Automotive Service members throughout the United States.

This information will supplement the more than 2,000, 9¼x12¼" pages of information in the National Automotive Service Manual.

According to the publisher of this



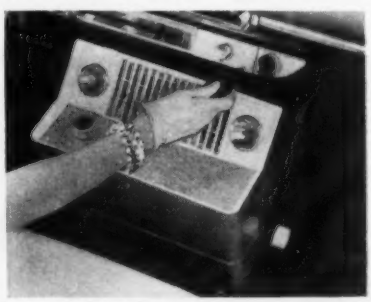
service the new National Automotive Manual is the world's most comprehensive guide for auto repairs, offering an exceptional all-around reference for service mechanics covering every model and make of U. S. and Canadian built cars since 1946 to date.

The 1958 new model car facts are published as loose-leaf supplements which are easily inserted into the master single volume.

(Use Reply Card for Further Information)

Portable Air Cooler

A portable auto air cooler, recently announced by the Wright Mfg. Co., is readily adaptable to auto, motel, home and office use. Its lines and color tones harmonize with new car



interiors, and the compact size fits nearly all American automobiles. The cooler operates simply by plugging into the cigarette lighter, to provide cool, filtered air throughout the car whether it is moving or parked. A small, inexpensive accessory transformer is available to convert 6- or 12-volt DC auto coolers for use on household 110-115 AC current.

Other features include: directional

airflow control; choice of 6- or 12-volt model; handy gadget tray to hold traveling accessories, and easy removal.

(Use Reply Card for Further Information)

Screw-Holding Screwdrivers

Kedman Co. announces a new gift package containing three of the most popular sizes of their Quick-Wedge

SCREW-HOLDING SCREWDRIVERS
New gift package of Quick Wedge SCREW-HOLDING screwdrivers. They hold, start and drive the screw. Suggested retail $3.98
KEDMAN CO., 233 So. 5th West Salt Lake City, Utah, Manufacturer

Screw-Holding Screwdrivers—which are designed so as to hold, start and drive screws.

The screwdrivers are available with 2″ to 14″ blades, and in four bit sizes. Blades are of high-quality spring steel; handles of shock proof, unbreakable Tenite II.

(Use Reply Card for Further Information)

Portable Ignition Scope

A new, portable ignition scope, featuring an easy pattern interpretation guide, is announced by Allen Electric and Equipment Co. Requiring only four controls for the complete range of tests, the scope enables the operator to examine a single cylinder firing pattern or make a side-by-side comparison of 4-, 6- or 8-cylinder engines at engine speeds from 600 r.p.m. to 8,000 r.p.m. Faulty ignition condensers, coils, reversed coil polarity, percent of point dwell, defective points, shorted or fouled plugs, and series resistance in plugs or cables are said to be quickly detected with the unit. Failures in the primary circuit are automatically reflected in the secondary circuit pattern, thus eliminating the need for a separate reading.

The pattern interpretation guide (Allen's exclusive Scope Dial-Chek) is said to make pattern interpretation a simple matter of comparing the scope pattern with one of the nine separate patterns shown on the Dial-Chek. An explanation of the ignition failure causing each pattern is given, along with instructions for correcting the trouble.

The Scope is portable and has rubber feet to protect the car finish when being used on the fender of a car.

(Use Reply Card for Further Information)

Small Plug Merchandiser

To give a lift to the rapidly growing market for marine and small engine spark plug sales, Electric Auto-Lite Co. announces a new colorful merchandiser designed to display thirty-six individually boxed marine and small engine spark plugs on counters, shelves, and in windows. A cross reference chart is printed on the back of the display, and provision is made for including free servicing and specification information.

(Use Reply Card for Further Information)

Clean-O-Matic Parts Washer

Graymills Corp. announces the Clean-O-Matic Parts Washer, which has been designed to incorporate suggestions and ideas for improvement as submitted by automotive shopmen throughout the country. Among the new features of the Model 300 are:

Easier Servicing: The filter can be serviced in less than 5 minutes because it is above the liquid level . . . New type sludge collectors practically eliminate the need for draining, which, according to the manufacturer, can now be done just once a year. The rest of the time they can be pumped out and the sludge which collects in the movable trays can thus be removed easily.

Convenience: Height of the unit is comfortable for the average mechanic, with no back breaking stooping necessary. The switch is placed conveniently at the front, with new signal light feature. The automatic self-setting safety cover opens and closes with one hand, thereby reducing fire hazards. The flush hose is conveniently located and the exclusive jet nozzle is said to be a boon to fast, efficient parts cleaning.

The Clean-O-Matic is sturdily made of heavy gauge steel with a rugged pump which is said to defy breakdowns.

The cleaner operates with hydro-jet or air agitation, and with the jet nozzle and flush hose is said to give more thorough cleaning with filtered solvent.

(Use Reply Card for Further Information)

Rubber Lubricant

A new rubber lubricant formulated by American Grease Stick Co. to meet industry standards for safe applications on all types of rubber, as well as for mounting and demounting all types of tires, is being marketed by The Goodyear Tire & Rubber Co.

The product—called RuGlyde—is recommended for lubricating tires, tubes (flaps) and passenger and truck tubeless tires; lubricating rubber parts and fittings safely and effectively and for cleaning and dressing-up rubber floor mats (regardless of color), tires, weatherstripping and rubber accessories.

Applicable to all kinds of rubber, it has "controlled friction" and the proper viscosity to protect against slippage, helps prevent damage to beads of tubeless tires and permits bead seating with minimum pressure.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

King Powerlite

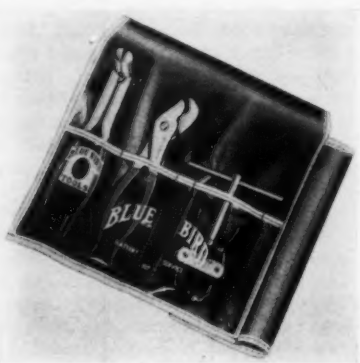
The King Electric Equipment Co. announces a light-weight, highly polished chrome-plated pistol style 6/12 volt power timing light housed in a rugged die-cast metal case for protection against rough handling. The light is said to be shock-proof when connected for use, even though the case touches a spark plug, and it is also stated that the optical system provides a sharply focused beam, bright enough for timing a vehicle in direct sunlight.

The Powerlite operates only when the trigger-switch is depressed, thus more than doubling the expectant life-span of the product and the manufacturer states that vehicle battery polarity may be safely disregarded in connecting for use on either a 6 or 12 volt system.

(Use Reply Card for Further Information)

Battery Service Kit

To streamline battery service for maximum efficiency and minimum danger of damage to the battery, Bergman Tool Mfg. Co. announces a Blue Bird Battery Kit which contains three essential battery tools — clamp spreader for spreading and cleaning terminal clamps and terminal posts; a terminal clamp lifter (which is said to remove the most badly corroded clamp) and a general purpose, wrench-grip battery plier.

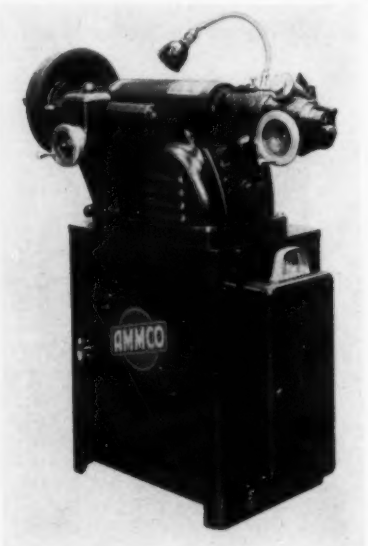


The tools come packed in a sturdy blue plastic case, and when rolled up is small enough to slide into a pocket.

(Use Reply Card for Further Information)

Metered Drum Lathe

Ammco Tools, Inc., announces that their Model 3000 "Safe-Turn" Drum Lathe is now available with a coin meter attachment. By inserting coins in the meter, ample time is allowed for turning the drums; the rate being figured so as to allow a substantial profit to the operator. Part of the money collected in the coin meter goes toward purchase of the machine. Ammco reports that this plan is being accepted with enthusiasm; with many shops instigating a do-it-yourself drum turning program with other shops in their vicinity, with the coin meter doing the billing.



(Use Reply Card for Further Information)

Automatic Transmission Fluid

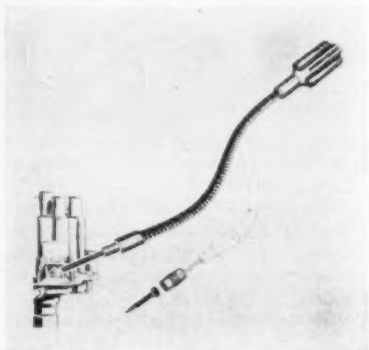
The Kendall Refining Co. is marketing a new automatic transmission fluid, carrying General Motors approval and designed primarily for the "fine car" field where greater resistance to oxidation is required.

Carrying the approval number AQ-ATF-670A, the higher V.I. of this fluid is said to provide smoother, more quiet shifting, while its greater oxidation stability is aimed to resist deposit formations. It is available in 1 and 5-quart cans, 5-gallon pour-spout pails, and 30 and 55-gallon drums.

(Use Reply Card for Further Information)

Flexible Adjusting Tool

To facilitate the adjusting of distributors and carburetors on a running engine, Rinck-McIlwaine, Inc., is now offering a semi-flexible adjusting tool which can be bent as needed to clear obstructions in the engine compartment—and it holds its setting; there is no backlash or "whip." White lines on opposite sides of the tool's handle permits mechanic to measure exact amount of turn.

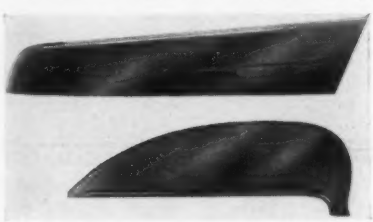


A hardened hex wrench (⅛") swedged to the end of the flexible shaft is used for making distributor adjustments. Carburetor adjustments are made through use of a hooded screwdriver attachment which is broached to fit the ⅛" hex wrench.

(Use Reply Card for Further Information)

Fender Skirts

A complete line of fender skirts for passenger cars and certain series of trucks, are now being offered by Perfection Automotive Products Corp.



Said to incorporate many new features in design and construction, the skirts are available for 1958 and older models in flush mounts, outside mounts and specialty numbers—with emphasis placed on proper fit.

(Use Reply Card for Further Information)

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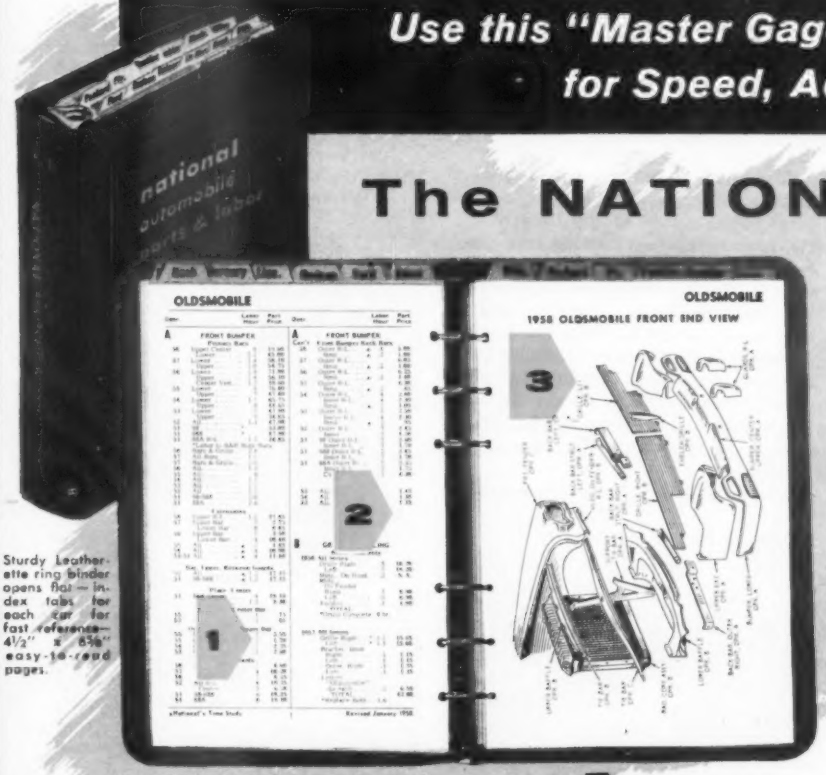

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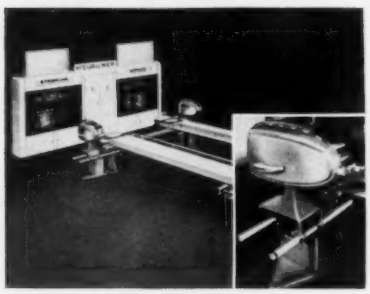
AD.

These are new *manufacturers' products*

"Modernizer" Saves Time, Space

A wheel aligning "change-over" unit—the "Modernizer"—is announced by The John Bean Division to provide speed and precision to practically all ramp and pit-type aligners and frame



straighteners now in use. The system is easily installed, and only 78" is required from the center of the turntables to the background for projecting the unit's alignment readings.

The Visualiner heads, with their special supports for securing the unit to the floor, are installed beside the present aligner turntables. The change-over unit allows tools, turntables and runways from the present unit to be used with the new equipment, which consists of two Visualiner heads complete with two front wheel mirror and two rear wheel mirror assemblies and necessary checking fixtures.

(Use Reply Card for Further Information)

Power Brake Display

A new point-of purchase power brake display which features ease of installation and the fact that a power brake can be installed on a customer's present car, is now being offered by the Bendix Automotive Sales Dept.

The display contains a "Touch-Toe" Hydrovac power brake unit and the accessory fittings needed for installation, as well as a simplified, illustrated instruction sheet and window streamer.

(Use Reply Card for Further Information)

Plugs for Volkswagens

A new 14mm spark plug, tested and approved by Volkswagen has been announced by the Champion Spark Plug Co. Called the L-85, it has a special reach of .472" and a thread relief to make it perfectly tailored for use in the German automobiles.

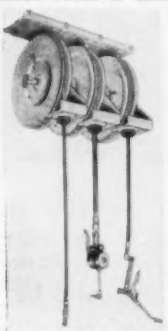
The L-85 is manufactured with a fixed outside gasket designed to prevent possible loss at the time of installation. Another feature is a steel terminal stud which resists chafing of the German terminal connector. The new spark plug is comparable in heat range to the L-7 and the L-10S.

In addition to Volkswagen, the L-85 has also been tested and found to give excellent performance by the German manufacturers of Borgward, BMW, Goliath, Lloyd and Porsche automobiles.

(Use Reply Card for Further Information)

Overhead Lube Reels

A new economy line of overhead hose reels is announced by the Aro Equipment Corp. The new reels are finished in dirt-resistant bronze enamel, and are not enclosed, which permits a cost saving for service shops where white and gray enameled housings are not desired.

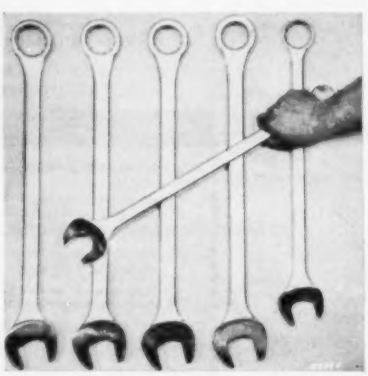


An automatic reel latch holds withdrawn hose in any position, and strong spring-return action retracts hose smoothly after use.

(Use Reply Card for Further Information)

OTC Adds to Line

Six large-size combination wrenches —1⅝", 1 11/16", 1¾", 1 13/16", 1⅞" and 2"—have been added to the

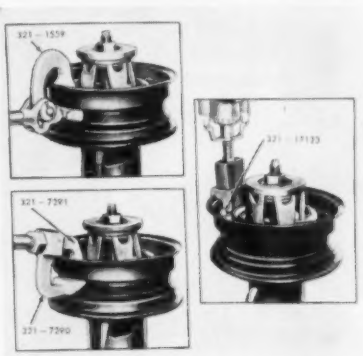


Owatonna Tool Co. wrench line. Both the open-end and box-end are at a 15° to the handle.

(Use Reply Card for Further Information)

Wheel Straightening Tools

The Bear Mfg. Co. has modified their line of wheel straightening tools so as to handle the deeper drop center



wheels being used on today's cars. Shown here are the rim block adaptor (321-17123); rim lever (321-7291); rim hook (321-7290) and the rim tool jaw (321-1559). All these revised parts are now being supplied on current Bear wheel straightening equipment.

(Use Reply Card for Further Information)

External Mix Nozzle Spray Guns

Two new low priced lightweight spray guns for general maintenance or occasional paint jobs are announced by the Binks Manufacturing Co. which

can be used for spraying all types of paints and fast drying lacquers. They have been designated Models 35 and 36, and can be used with air compressors rated to 1 hp.

Both models allow the use of an external mix nozzle set up so that fast drying materials may be sprayed without constant nozzle buildup, even while using as small as a ¼ hp. compressor. On the Model 35, a simple, one knob adjustment accomplishes the change from siphon to pressure cup feed.

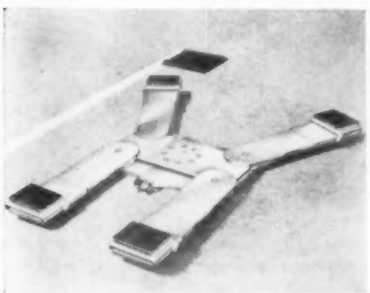
The Model 35 spray gun comes equipped with a one-quart siphon cup, and is a bleeder type without air valve. An internal mix nozzle is available for use in covering large areas quickly and efficiently. The Model 36 is best adapted for use with a fluid pressure tank, and is a non-bleeder type and requires a constant speed unloader on the compressor.

(Use Reply Card for Further Information)

"Quick Spot" Chassis Lift

A new automotive chassis lift is announced by The Joyce-Cridland Co., featuring a one-piece superstructure with four moveable arms adaptable to any automobile or light truck chassis —including sport cars and foreign cars.

The compact lift superstructure is



45⅝" high overall and 32" wide when arms are not extended laterally. According to the manufacturer, the lowest sport cars or foreign cars can easily clear arms and pads, and the smallest narrow tread cars can straddle them. Overall rail length is 70", or 86" when pads are extended over arm ends; height of rise is 70" and capacity is 8,000 lbs.

Other design features include: a one-wheel locator for guiding left front wheel, automatically centering every car for balanced lifting; a hole in each pad center which allows a handle to be inserted for sliding or raising pads, and a non-rotatable device and safety latch for jacking unit.

(Use Reply Card for Further Information)

Brake Bleeder Kit

By using the "Bleed-Ezee" kit, recently announced by the Associated Spring Corp.'s Raymond Mfg. Div., one man is said to be able to bleed

two brake wheel cylinders at one time, in just a few minutes with practically no loss of brake fluid.

According to the manufacturer, the procedure is simple and quickly learned. After checking the fluid level in the master cylinder, the shopman removes the bleeder fitting from the wheel cylinder if it is dirty, cleans and unplugs it, and then replaces it tightly. Next, he attaches the "Bleed-Ezee" tool to the cylinder fitting on one or more wheels, using hand pressure only; then he opens the cylinder fitting ¼ to ½ turn, depresses the brake pedal to firm pressure, and then releases it, after which the cylinder fitting is tightened and the tool removed.

The kit contains two bleeding tools and a bleeder valve extension, as well as two adapters for small-size fittings, conveniently packed in a vest-pocket sized plastic box.

(Use Reply Card for Further Information)

Automatic Transmission Linings

A new automatic transmission lining for 1958 automobiles has been developed by Raybestos - Manhattan, Inc., from what is said to be the

thinnest woven asbestos lining ever produced.

In addition to its thinness, the one-piece lining is quite flexible, and the combination of strength and flexibility is said to make it easier to apply and bond to the metal band.

Designated as U. S. 4523, the transmission lining is produced in a range of thicknesses from .040" to .125". All thicknesses may be grooved.

(Use Reply Card for Further Information)

Built-In Tire Gauge

The No-Lo Tire Pressure Indicators, recently announced by the Frebank Co., were designed for fleet owners, to eliminate the time-consuming problem of checking truck and trailer tires with a conventional tire pressure gauge. They can also be used equally well on passenger cars.

The device is easily attached to the tire valve stem in place of the conventional valve stem cap. Drops in air pressure (6 lbs. or more) are indicated automatically by the No-Lo Indicators when the red tip of a pressure control rod slides back into the valve where it cannot be seen. As long as the air is at a safe level, the red rod remains visible and the driver or maintenance man need only glance at the indicator to tell whether the tire has lost more air than is safe for proper operation.

The units are pre-set at the factory in increments of 2 pounds (from 22 to 34) for passenger cars; and increments of 5 pounds (from 40 to 105) for trucks.

The indicators are 1" long, ⅞" in

circumference, weigh ⅛ ounce each and made of a non-corrosive, bright dipped aluminum and specially compounded neoprene seals that are impervious to all atmospheric conditions. The indicator rod operates up and down actuated by a stainless steel calibrated spring device. The units, in laboratory tests, have been aged, baked, frozen, water immersed and subjected to all conceivable conditions that may be found in actual service.

(Use Reply Card for Further Information)

Mechanic Stand

A new mechanic stand, made of ¾" standard galvanized pipe which slips firmly over all sizes of truck

tires, is announced by the Hudson T. Marsden Mfg. Co., Inc. Safety grip tread provides an anti-skid surface for safe footing.

Adjustable cross tees with sure locking set screws make it easy to adjust for various heights.

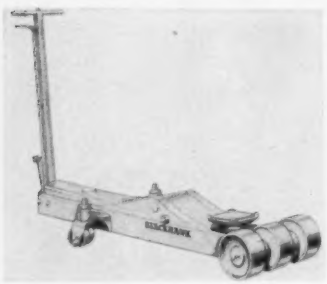
(Use Reply Card for Further Information)

These are new *manufacturers' products*

20-Ton Floor Jack

A new 40,000-pound capacity hydraulic service jack (model SJ-20) is announced by the Blackhawk Mfg. Co., to handle the tremendous loads of today's modern trucks, construction equipment and other off the road vehicles.

The new service jack has an extra



long (68½") heavily reinforced main frame. Sturdy lifting arm and three large front wheels provide exceptional load carrying ability.

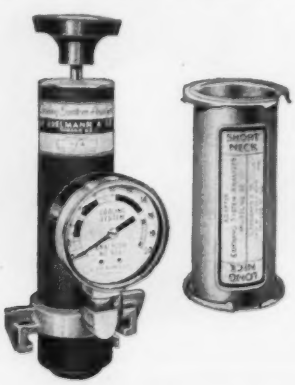
The convenient foot operated pedal quickly lifts the saddle to contact the load, and once contacted, there is said to be little handle effort, even with full 40,000-pound loads. Dual caster wheels enable the jack to be spotted quickly and easily maneuvered.

The SJ-20 has a lifting range of 19" . . . from a low saddle point in 1½, 2, 4, 10 and 20-ton capacities.

(Use Reply Card for Further Information)

Cooling System Tester

A new heavy-duty cooling system analyzer being offered by E. Edelmann & Co., is said to quickly show



up pinholes or leaks in radiator, cylinder heads, gaskets, engine blocks, hoses, water pumps and heaters, as well as defective pressure caps.

New design in valve and pump housing insures rapid pressure build-up. The accurate, extra-large dial instantly shows whether rated pressure holds within or drops below proper range for each pressure zone in 4, 7, and 14-lb. pressure systems. Two-way rubber bushing fits long and short neck radiator openings. A real improvement over earlier models, extra-heavy cast engaging lugs prevent breaking or bending, assure positive alignment at all times.

(Use Reply Card for Further Information)

Power Tire Changer

Big Four Industries' new Model P-58 power tire changer is equipped with a Powair-Pak that uses air pressure from the regular air compressor to make child's play of breaking even

the most stubborn beads. With its unique finger-tip control, the operations of locking the rim in place, breaking the beads, then releasing the tire, can be performed merely by flipping a six-inch ball lever through three positions. The Powair-Pak will also be available as a package to fit older model Henderson Air-Lock Tire Changers.

Other features include: new Wedge-Wing bead-breakers that are said to free beads four times as fast, preventing binding or twisting of beads; proven safety-lift demount tool; and Big Four's bead-protecting mounting tool.

(Use Reply Card for Further Information)

Engine Block Cleaner

A new cleaning combination for still tank cleaning of engine blocks prior to repairing is announced by The Magnus Chemical Co., Inc., which is said to reduce cleaning time to the point where the filthiest blocks can be cleaned thoroughly in two to four hours. Wire brushing time is cut to a minimum, and in many cases it is said to be completely eliminated.

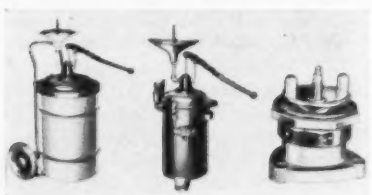
The faster cleaning speed is brought about by the addition of Magnus Activall, a new and potent "booster," to Magnus 61RS, in itself an excellent alkaline hot tank cleaning compound. The addition of Activall is also said to prevent scum formation at high concentrations and to extend life of the cleaning solution by twenty per cent. Improved rinsing is assured through an added rinsing agent, and redepositing of soils on parts is said to be eliminated.

(Use Reply Card for Further Information)

Wheel Bearing Packers

To make wheel bearing packing easier and more profitable, Lincoln Engineering Co. announces three Kleen Pak models especially designed for portability and versatility.

Recommended for original 120-pound refinery drums is the Model 842. Mounted on a two-wheel dolly truck, this portable unit can be moved quickly and easily to any part of the shop. It comes with an adjustable, rust-proofed drum cover, which fits drums up to 15" in diameter. Portable



Model 843 has convenient carrying handle and two grease gun brackets. In a matter of seconds, the packer and pump assembly can be removed as a single unit, and the all-steel container is ready to be refilled with up to 30 lbs. of lubricant. Both models come equipped with packer and pump assembly.

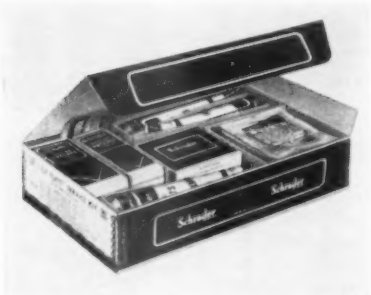
The third unit is the Model 816, designed for servicing roller or ball type wheel bearings. As a versatile packer, it can be mounted on a wall or workbench. Bearings can be flushed and packed by contacting fitting in packer head with control valve from chassis ceiling reel, power gun, or by high-pressure hand gun.

(Use Reply Card for Further Information)

Say You Saw It In
Automotive Service Digest

Self-Vulcanizing Patches

To repair tube and tubeless tire punctures up to ¼" diameter, A. Schrader's Son, has added self-vulcanizing patches to their long line of tire inflation and service products. The new patches, called "Fix Flats" Patch Units, offer to the service field a cured-on process which is entirely



a cold-type repair. Self-vulcanizing eliminates the heat, smoke and troublesome vulcanizers commonly associated with past tire repair.

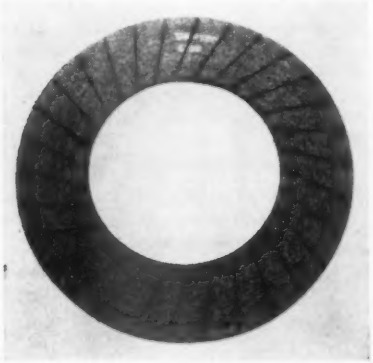
Made in six sizes to accommodate both tube and tubeless punctures of varied size, the patches are of multi-ply construction consisting of a protective Holland Cloth covering, a layer of quick curing gum and multiple layers of tough flexible rubber laminated for extra strength. The 3¼" round patch, recommended for tubeless repairs, is reinforced with nylon cord in addition to the natural flexible rubber lining. The self-vulcanizing fluid is contained in a four-ounce dispensing tube for convenient application.

Patches can be ordered in individual package units with separate self-vulcanizing fluid or in complete combination service kits.

(Use Reply Card for Further Information)

New R/M Clutch Facing

A new clutch facing material, which is said to have an extremely high



centrifugal burst strength in dry applications, has been developed by Raybestos-Manhattan, Inc.

Known as Pyrotorq, the material is made of non-woven asbestos felt specially compounded to provide good durability and smooth engagement within the desired friction range.

(Use Reply Card for Further Information)

Paint Spray Equipment

DeVilbiss Co. announces a new remote cup painting system which is said to reduce operator fatigue, increase production and permit higher quality work.

Fundamentally, what DeVilbiss engineers have done is to separate the paint cup from the paint gun. Freed from the cup, the lighter, more maneuverable spray gun can be used

properly for painting the less accessible parts of a car or truck, and, because of pressure feed control, do a better, over-all job with a wider variety of paint materials.

Leading a list of benefits claimed by the manufacturer for the new method are: (1) Five-way spray control, including fluid pressure regulation, control of fluid flow rate, air flow adjustment through a regulating valve, pattern size control by spreader adjustment and atomization air pressure regulation through the conventional transformer. (2) Ideal balance for fluid flow and atomization air for better quality with every type of finishing material. (3) Non-stop painting with the double capacity cup, which is said to put an end to dry edges resulting from start-and-stop spraying. (4) No drip from vent holes to spoil hood, top or rear deck surfaces. (5) Uniform spray pattern through a greater range of pattern sizes. (6) Visible fluid pressure check for better spray control at all times. (7) Overspray is reduced by facilitating the proper spray angle on all surfaces.

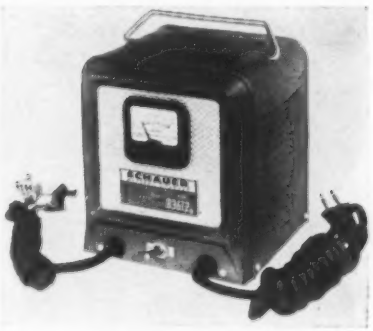
The equipment consists of a production type gun, two connecting ¼" hoses 40" long (black for fluid and red for air) and a two-quart cup equipped with precision regulator, built-in safety valve, atomization air adjustment valve, screw type relief valve and an easy-to-read pressure gauge.

(Use Reply Card for Further Information)

Home-Type Battery Chargers

Schauer Mfg. Corp. announces a new complete line of home-type battery chargers to meet every battery charging requirement for owners of cars, trucks, tractors, powerboats or airplanes. Chargers for 6-volt batteries are available with 4, 6, 10 and 20-ampere charging rates; for 12-volt batteries at 3, 6, 10 and 20-ampere rates; and for both 6 and 12-volt batteries at 4, 6, 10, 20 and 80-ampere rates. The latter units are equipped with a selector switch for changing the operation from one voltage to another.

All models provide a safety tapering of the charging rate as the battery becomes fully charged. All but the smallest chargers have an accurate numeral dial ammeter which shows the exact charging rate going into the



battery. Full wave selenium rectifiers are used, and a "charger guard" provides automatic protection against short circuits and overloads.

The new models are compact and light in weight. They may be connected directly to the battery, or the charge may be introduced through the car's lighter receptacle by using a "charger plug" accessory. Another accessory available is the "charge time" which permits leaving the charger in operation over extended periods of time without attention. Equipped with a built-in timer, it will shut off the charge at a pre-selected time within a period up to 12 hours, and then will permit a low-rate trickle charge to be introduced in order to maintain the battery in fresh condition until it is disconnected.

(Use Reply Card for Further Information)

Say You Saw It In
Automotive Service Digest

Steering Tube Movement A Normal Condition

Should owners of 1958 Chryslers and Imperials equipped with power steering complain of a 1/16" to 3/16" axial (in and out) movement of the steering wheel and steering tube, you can assure them that *it is a normal condition and needs no correction.*

According to the Chrysler Service Department, there has been axial end clearance of the steering tube of all integral power steering units used by the company. The axial movement of the "Constant Control" power steering tube is restricted and controlled by a 60 lb. spring load under the steering wheel hub. If an owner should object to this normal axial movement of the steering tube, it can be reduced by installing an additional spacer washer between the bearing race and spring. However, do not install a washer under the bearing, as this may adversely affect the steering in a left turn and/or may ruin the returnability from a right turn.

To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section

KAL-TUNEMASTER . . . the tune-up tools with the built-in know how. Actually create extra selling opportunities . . . extra profits. New free booklet tells how.

WRITE FOR HELPFUL FREE BOOK, "PROFIT BY EXPERIENCE" . . . tells from actual experience how to turn common car "complaints" into sales of tune-up, replacement parts, service and accessories.

ASK FOR BOOKLET F-65-A

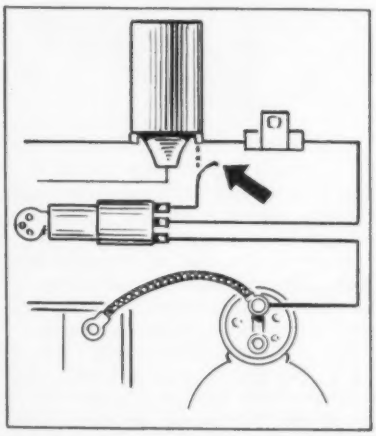
KAL-EQUIP COMPANY
BOX 567
KALAMAZOO, MICHIGAN

Instrument Corner . . .

(Continued from page 10)

the cranking motor operated again.

Although normal cranking voltage at the coil would have been about 9 volts, the meter showed only 6! The service man now knew the trouble—the reading told him that the circuit through which the current bypasses the ignition system resistor when the cranking motor operates, was open. Coil voltage was being reduced by the drop through the resistor in addition to the normal battery drop caused by the heavy starting load.



Careful checking revealed that the end of the bypass circuit wire had worked loose from its terminal. Once the circuit was re-established, the car started normally!

This car owner had paid plenty for new parts and labor, when all it took to solve the trouble—and win his good will and future business—was to reconnect a loose wire!

Adjusting Chevrolet Front Wheel Bearings

A new method of adjusting Chevrolet front wheel bearings, announced by the factory, is said to provide a more accurate bearing preload. It is recommended for use on 1958 models, as well as on all past model Chevrolet passenger cars that specified a torque setting on the spindle nut of 33 ft. lbs.

The new adjustment procedure is:

1. Tighten adjusting nut to 28 ft. lbs. torque and rotate hub and drums to seat components.
2. Back off adjusting nut until bearings are loose and re-torque to 12 ft. lbs.
3. If a cotter pin hole and slot align, insert cotter pin. If not, back off until nearest hole and slot align and insert cotter pin.

Ford's German-made Tanus Makes Debut

• A NEW CONTENDER among the small-car imports is the Tanus—a product of the Ford Motor Co. of Germany.

Featuring unitized body construction, the six Tanus models are powered by an economical, overhead valve,

Ford of Germany's 5-passenger Tanus sedan

four-cylinder, short stroke engine which develops 67 brake horsepower at 4400 rpm and 97.6 ft.lbs. of torque at 2200 rpm. Engine displacement is 103.62 cu.in. and compression ratio is 7.1:1. Test runs over American roads at 40 m.p.g. showed an average of 35.3 m.p.g. fuel consumption. Cruising speed is said to be 78 m..p.h.

An extra cost option is an automatic clutch called the "Saxomat" which entirely eliminates the clutch pedal. All shifting is accomplished simply by moving the gear shift lever on the steering column to first, second, high or reverse gear. An electric control switch in the gear-shift lever actuates the magnetic clutch-operating mechanism automatically.

Riding and handling ease results from a combination of the MacPherson independent, front suspension and the semi-elliptic, progressive-acting rear springs which adjust themselves to load and road conditions. Front suspension employs a high-mounted coil spring and shock absorber combination with a large tubular member extending from the lower control arm upward into a spring tower in the engine compartment. A front sway bar is also used.

The Tanus will be available in two-door and four-door models, as well as a two-door Combi-wagon (station wagon) in both deluxe and standard models. Built on a 102.5″ wheelbase, their overall length is 172.2″, overall width 65.7″ and overall height 57.7″.

Wagner Brake Service Clinics to Stress Value of Job "Know-How," Thoroughness

In cooperation with its jobbers throughout the country, Wagner Electric has launched a series of brake service clinics especially designed to give extensive information during limited instruction periods.

With the help of demonstration charts, cylinder cut-aways and brake service literature especially prepared for these meetings, the clinics will cover hydraulic brake repair practices, proper application of brake lining, and fundamental brake information for all basic types of passenger car and truck brakes.

The clinics are especially timely during the present and anticipated shortage of well-trained brake mechanics, and emphasis will be placed on doing work to produce safe brakes. Theme of the meetings will be "You Can't Guarantee the Work you Don't Do," in keeping with the fact that parts of the brake system work as a team, and only partial brake service may not be satisfactory.

NEW LIFE FOR OLD ENGINES!
RESTORE NEW-CAR POWER...
SPEED...ECONOMY...
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FOR FORD OVERHEAD VALVE ENGINES
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HOUSER
For only a few pennies, HOUSER SHIMS renew lost valve spring tension . . . overcome effects of valve grinding and wear. By restoring full factory-specified tension, they eliminate valve flutter and surge, rough idling, and loss of power. If your Jobber performs your complete cylinder-head service, ask him to gauge and shim the valve springs for complete customer satisfaction.
Houser Shims Mean Extra Power for your Customers' Engines . . . Extra Service Business for You!
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TOOLS

IT'S NEW!

HERE'S WHAT
WE SAY ABOUT...
PROTO'S CLIK-STOP
ADJUSTABLE WRENCHES
PAT. PEND.

"... it sure saves time & skin off my knuckles."
Charlotte, Michigan

"It helps me to turn in more labor ..."
Windsor, No. Carolina

"... never changes size while working with it."
Waco, Texas

"It's good, and something needed for a long time."
Derry, New Hampshire

"... it eliminates resetting the size every time ..."
Oakland, California

"Your wrench is the best I've found..."
Butler, Pennsylvania

The Service Manager . . .

(Continued from page 41)

"New car purchasers are introduced to the service manager so that he may cement a relationship tying this customer to the dealership for his future business. This introduction may be in the showroom, service floor, car lot, street or wherever the delivery is made. When he is on this diplomatic mission it is easier to call him on the address system than to go looking for him.

"Scheduling new car setup is usually left to the service manager; so he may make several visits to this department daily to discuss accessory installations or removals, according to the order. Or he may push up a quickie sale ahead of an anniversary present vehicle not due for delivery for a week or so. Special adjustments may be indicated at set-up time if a series of complaints from new car owners show on check-up orders. The service manager watches for these 'bugs' to squelch future complaints.

"Factory product reports and contacts also take time, and may occur at various hours and places. While involved with them, the service manager won't be instantly at hand.

PERSONAL TOUCH MOST EFFECTIVE

"Customer follow-up can be delegated, down to a certain point. The routine checking, calling, mailing and the like can be handled by others; but when a complaint is uncovered it falls on the SM to make the necessary adjustment and bring the irked customer back into the fold. Planning advertising programs to bring in work, and evaluating the results of various methods is a job for the SM. It's been my experience in this mailing contact that the personal touch is most effective. Instead of some agency blurb which may be cute but is obviously for generalized use, I like to work out some offer that has local appeal and then use a picture of our shop and our men or equipment, that is recognizable to the customer.

"But, as for your question about 'Where's the service manager,' I can only say he is where you find him—and if you don't hurry he'll be someplace else before you get there."

Since we gathered this information from Leonard Clarke and snapped a few pictures of his activities while he was "working his beat" we are forced to agree that a busy service manager is usually on the move and not easy to find during his working hours. But this one is equally difficult to find during his weekends or evenings. While he tries to devote as much time as possible to his ranch-type home, wife and three handsome daughters,

he is not infrequently contacted for a civic meeting, asked to fill the pulpit at some outlying church needing a substitute pastor . . . or perhaps instructing a group of students on the marvels of astronomy and how he constructed one of the telescopes used in pursuit of that hobby.

Dutch DAF "Bug" Debuts Without Clutch or Shift

• DRAWING CROWDS at the recent 39th international motor show at Amsterdam, was the first all-Dutch passenger car to appear on the market since the *Spijker* was dropped from production in 1927. Developed under the direction of Dr. H. J. van Doorne, the small economy car is known as

"DAF," popular abbreviation of the manufacturer's name — van Doorne Automobielfabriek.

DAF's outstanding technical feature is "Variomatic" transmission, described as "continuously variable transmission and automatic reduction selection between 20:1 and 4.4:1, forward; 20:1 reverse"; and said to function also as "maxi-grip differential and homocinetic joint of the swinging half-axles." Engine, transmission and suspension members are carried on flexible rubber mounting, eliminating lubrication requirements.

Featuring an air-cooled two-cylinder engine of 36 cu.in. capacity, 7:1 compression ratio, DAF is rated 22 hp at 4000 rpm; reported to have maximum speed of 58 mph, fuel consumption of 48 mpg. Body construction is chassiless pressed steel sheet. It will retail in Holland at 3980 guilders (approx. $1085) for the Standard model, and is expected to sell well throughout Western Europe once domestic demands are met.

Plymouth Oil Dip Stick May Need Altering

Should you find that the oil level in a 1958 Plymouth engine (6- or 8-cylinder) does not register properly on the dip stick, the factory recommends cutting off a section *at the top of the tube* to correspond to the amount of error on the dip stick reading.

IT'S NEW!

PROTO'S CLIK-STOP ADJUSTABLE WRENCHES PAT. PEND.

GOLDEN KNURL HOLDS EXACT JAW OPENINGS AUTOMATICALLY!

NO BUTTONS... NO LEVERS... NO GADGETS

Meets Federal Specifications: GGG-W-631A, Type 1

Now Available in FIVE SIZES*

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PROTO TOOLS
PROTO means PROfessional TOols
DIVISION OF PENDLETON TOOL INDUSTRIES

Let's Face It . . . Foreign Cars Need Service, Too —And It Can Mean Extra Profits for You!

• IF TRADE predictions hold true, another 150,000 of those sassy little imported cars will be reaching our shores during 1958 (that's a 65% increase over 1956 imports!).

In many areas where these little cars are so popular, service demands have over-taxed the dealers, and foreign car-owners are beginning to turn to other service outlets for routine servicing. Where this happens, it often pays shop operators to cater to their needs and establish them as new customers, but according to a recent A.A.A. bulletin there are a few factors which are "out-of-the-ordinary" when it comes to foreign car service, so watch out for them if you want to avoid damage.

1. Not all foreign cars employ standard American thread on bolts, nuts and other components. These cars are often equipped with a fairly complete tool kit, however, and shopmen can avoid damage by using car owner tools—or, if any amount of this work is contemplated, it will pay to purchase the necessary metric sized tools for foreign car work.

2. Check the owner's manual before using certain motor oils. In some instances, the manufacturers may caution against oils with additives.

3. Be sure that someone guides the car onto a lift . . . it may be a very tight squeeze, and a slip at the wrong moment could do extensive damage.

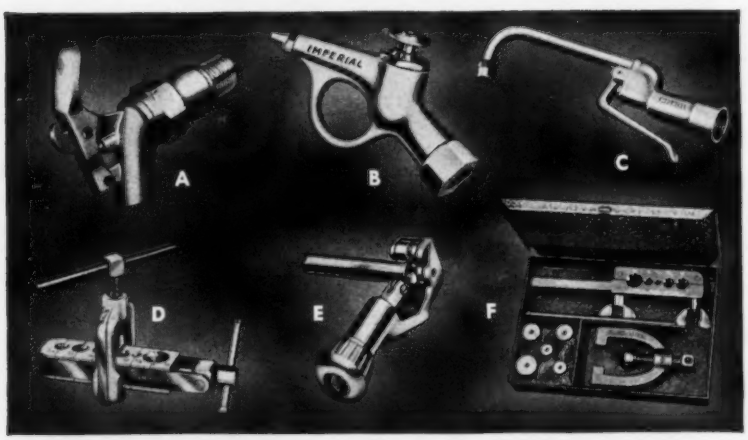
4. Some rear engine cars have the gas and water fill pipes close together, and because they look alike, *be sure you use the right one!*

5. Check the owner's manual before adjusting brakes (unless you are familiar with the system employed). Some imports feature disc brakes. Adjusting mechanism often differs from U.S. type and some cars use a combination of mechanical *and* hydraulic.

6. Tow with added care. Bumpers and gravel pans may bend easily, and on at least one model, a bent bumper may prevent either the trunk or the engine hood from opening.

Save time...save work in the shop

Collect bonus profits with IMPERIAL products



Ⓐ **No. 261-G Imperial Self-closing Drum Faucet** — Metal-to-metal seat. No washers to wear out or cause leakage. Fast flowing. Locks open or closed. Fits 1" opening in standard steel drums. Ea. **$1.07**

Ⓑ **No. 47-A Imperial Air Nozzle** — For compressed air lines. Button control. Oil-proof rubber washer prevents air loss. Has ¼" Fem. P.T. hose connection. Each . . . **$1.65**

Ⓒ **No. 291-G Imperial Radiator Water Faucet** — Anti-splash. Self-closing. Spring-loaded trigger action. Made of brass and bronze. Each . . . **$3.75**

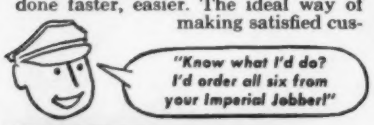
Ⓓ **No. 300-F Hi-Duty ® Flaring Tool** — Speedy, single-lever clamping. Makes 45° flares on 3/16, ¼, 5/16, ⅜, ½ and ⅝" O.D. tubing. Each . . . **$6.25**

Ⓔ **No. 274-F Tube Cutter** — Free-wheeling, ball-bearing action. Retractable reamer. Includes spare cutting wheel carried under reamer! For ⅛ to 1" O.D. tubing. Each . . . **$3.95**

Ⓕ **No. 93-FB Double Flaring Tool** — The only sure way to prevent cracking or splitting of steel tubing (such as Bundy or GM) when making 45° flares on 3/16, ¼, 5/16, ⅜ and ½" O.D. tubing. Each . . . **$9.65**

In your shop . . . Imperial products are service-engineered to get the job done faster, easier. The ideal way of making satisfied customers . . . building profitable repeat business. Make it a point to equip with Imperial tools and service aids like thousands of aggressive dealers are doing coast to coast.

Choose from hundreds of items. *Write for catalog 125.*



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IMPERIAL — *Emblem of Quality*

Brass Fittings Flexible Fuel Lines Anti-Freeze and Battery Testers
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Service Education Film Serves Dual Promotion Role

Aimed to help solve two of the car refinishers' major current headaches, "Modern Metal Magic," 16 mm color-sound presentation just released by Minnesota Mining and Manufacturing Co., consists of two sequences which can be shown separately or together.

Part 1, designed to encourage young men to become autobody craftsmen, tells the story of the undecided 19-year-old who is encouraged by a neighbor to visit a body shop and watch the work. Intrigued by the opportunity to work with his hands and be creative, the youth "signs on" for a few weeks of earn-and-learn. This section is suitable for screenings at training centers, manual arts departments of high schools, and private groups.

Threaded to the first by further experiences of the young man, Part II places emphasis on quality work—to educate the public to appreciate and insist on it—and is for showings before non-technical groups, business and civic organizations. It underscores the role of the autobody craftsman in his community business affairs.

Company sales representatives are handling distribution of the new film in their individual areas.

Protect That Chrome Work

When towing a customer's car, the towing cables frequently mar the chrome finish. To avoid this damage, cut two small sections of a tire casing and place them over the cables where they rest on bumpers or body trim.

BRUSHING UP ON THOSE

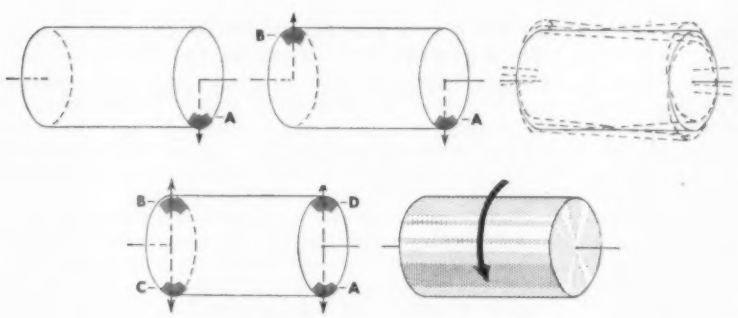
EASY-TO-FORGET THINGS

Refresher course

Static and Dynamic Balancing

• ILLUSTRATED ARE TWO important and necessary items to cause an object like a wheel or cylinder, to rotate smoothly on its axis at high speed. The two are static and dynamic balancing, the latter being by far the more essential. A wheel or cylinder may be in static balance but not in dynamic or running balance.

Shown, for example, is a cylinder with a weight at A. This causes the cylinder to come to rest with weight A, at the bottom. If an identical second



weight B, is put on the other end directly opposite to A, the cylinder is in static balance and remains at rest in any position. However, it is not in dynamic or running balance.

If the cylinder revolves rapidly, the weights A and B, produce a twisting "couple" causing the cylinder to wobble on its axis.

If weights C and D, (exactly the same as A and B) are placed as shown, they produce an opposing "couple" to affect a running balance. The cylinder is then in both static and dynamic balance, the two terms commonly used with balancing the wheels of a car, crankshaft or other rotating part.

SENSATIONAL tool for concentric mating brake shoes. Stops hard — fading — diving — erratic brakes

GP 380 MISSING LINK MATING TOOL

G 302 BRAKE BLEEDER and SERVICER

WORLD'S OUTSTANDING BLEEDER
Airtight expanding adapters and other features assure a better job. No fluid boil or air bubbles
Write for detailed story
GRIGG SPECIALTY TOOLS, DEPT. M
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An Engineering "Must" Every 1,000 Miles

- SMOOTHENS IDLING
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LOOSENS AND LUBRICATES

Fast and efficient . . . it frees, cleans, lubricates corroded and rusted parts. A must for auto and marine fittings.

A household hardware necessity. Use it on plumbing connections.

Buy it - or Write Today

RSA PRODUCTS CO.
1582 E. Warren Detroit 7, Mich.

The Dynaflow . . . (Continued from page 53)

the band adjustment access hole is almost completely covered when the transmission is installed in the car. Dynaflow bands seldom, if ever, require adjustment unless they are unusually worn. Then, band replacement is recommended.

THROTTLE LINKAGE ADJUSTMENT

With engine thoroughly warmed up, adjust throttle stop screw for proper idle r.p.m. Be sure accelerator pedal operates correctly and is in good condition.

Stop engine. Move throttle lever to *wide open* position. Make sure stator linkage does not hold throttle partially closed. With throttle wide open, stator rod should still have a slight amount of "play". If not, block throttle wide open, adjust upper stator rod so that the ball joint at forward end slips freely in stator lever or carburetor when stator rod is pulled forward. Then lengthen the rod one full turn to provide adequate clearance.

Continue throttle linkage adjustment by disconnecting throttle rod from lever on equalizer shaft. Adjust rod at carburetor end so that about ½" of thread is exposed beyond the lock nut.

With accelerator pedal pressed completely *down*, and throttle held *wide open* (a two man job), rod end should be about 1/16" *short* of entering hole in lever. Adjust rod length, if necessary, and connect rod to lever. With rod connected, recheck to be sure maximum accelerator travel coincides with full throttle.

Close throttle (hot idle), and check clearance between equalizer shaft lower lever and the stop lug which is mounted on the shaft-to-cowl bracket. This should be a minimum of ⅛". If necessary, readjust throttle rod length to obtain correct clearance. Occasionally, it may also be necessary to slightly reposition the shaft lever to bring the clearance into specifications.

DASH POT ADJUSTMENT

After throttle and stator linkage adjustments have been checked, and the engine is at normal operating temperature, manually place carburetor linkage at "fast idle". In this position, adjust dash pot until its stem *just touches* the throttle lever. Then back off the dash pot one full turn, and tighten lock nut. Check adjustment by applying parking brake and accelerating engine (in DRIVE) to about 1500 r.p.m. Quickly release accelerator pedal to see if engine stalls or idles too fast. Minor dash pot adjustments can be made from original setting to correct these conditions. However, the dash pot should be replaced if proper control cannot be obtained without serious misadjustment.

Grips the screw!
Drives it too!
Quick-Wedge
SCREW-HOLDING
SCREWDRIVER
2" to 14" blades. 4 bit sizes. Available with shockproof plastic covered tubing. Unconditionally guaranteed.
ASK FOR IT AT YOUR DEALER
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SHIFT CONTROL LINKAGE ADJUSTMENT

This linkage should be carefully checked for operation *before* adjustment is attempted. To check, move selector lever from DRIVE detent to the stop where the lever should be raised to go into NEUTRAL. Note the approximate amount of this travel. Then do the same thing between the LOW detent to the REVERSE stop, and note approximate travel. If the length of travel is about the same, the linkage is properly adjusted.

If adjustment is necessary, place lever in DRIVE, and disconnect the clevis on the lower shift rod. Place lever on transmission case in DRIVE detent (center position). Push idler lever *upwards* to the extent of its travel. In this position, adjust clevis so pin freely enters lever. Then *shorten* rod by turning clevis four (4) full turns. Securely install clevis pin. Recheck comparative selector lever travel. Slight readjustment of clevis is permitted to obtain the same relative movement.

If quadrant pointer is not correctly aligned after linkage adjustment, place lever in NEUTRAL. Carefully pry off quadrant dial. Loosen the nut which holds the pointer to the shaft. Correctly align pointer and leave 3/16" to 1/4" clearance between pointer and back plate. Tighten nut, snap dial in place, and recheck alignment.

Dynaflow is one of the very smoothest of all automatic transmissions. But as with every other automatic we have discussed, much of the satisfactory operation depends upon proper adjustments.

A clear understanding of Dynaflow's operating principles plus a careful, competent job of service adjustments, will enable the conscientious mechanic to insure Dynaflow's owners many miles of trouble free performance.

Next Month: Servicing the Powermatic.

Battery and Electrical Failures Head List of Car Troubles for '57

• ACCORDING TO THE American Automobile Association's annual car breakdown report, an estimated 55 million motorists had to call for help during 1957. Heading the list as top trouble maker (approximately one call in four) was battery and electrical failures, to edge out flat tires, long standing public enemy number one.

Extreme weather conditions in December and the early part of 1958 were blamed by the AAA as being largely responsible for the unusual increase in battery and electrical service calls answered by its 18,000 contract service outlets. Weather was also blamed for a 1½ per cent increase in ignition difficulties, the third most common cause of breakdown. Starter troubles were eighth in the list and "out of gas" calls dropped from sixth to seventh place.

The following list shows the number and percentage of each motoring problem as projected to total passenger car registrations:

	1957		1956	
Type of Service	Number	%	Calls	%
1. Battery & Electrical	13,287,000	24.23	12,018,000	22.47
2. Tire	12,574,000	22.93	12,906.000	24.13
3. Ignition	7,408,000	13.51	6,477,000	12.11
4. Tow or Wrecker	5,994,000	10.93	6,445,000	12.05
5. Stuck	2,884,000	5.26	2,856,000	5.34
6. Carburetor	1,969,000	3.59	1,883,000	3.52
7. Out of Gas	1,870,000	3.41	2,129,000	3.98
8. Starter	1,744,000	3.18	1,674,000	3.13
9. Gas Line	1,119,000	2.04	1,001,000	1.87
10. Lock and Key	866,000	1.58	851,000	1.59
11. Brakes	817,000	1.49	802,000	1.50
12. Lights	669,000	1.22	578,000	1.08
13. All Others	3,636,000	6.63	3,866,000	7.23
Total Breakdowns	54,837,000	100.00	53,486,000	100.00

Total Passenger Cars registered in 1957—55,899,000

Pontiac Dealers to Offer Vauxhall Station Wagon

Pontiac dealers throughout the country will soon be offering a newly designed Vauxhall Victor station wagon which incorporates most of the engineering features of the four-door sedan announced last September.

The Vauxhall Victor Station Wagon

To assume maximum performance under heavy-duty conditions, the rear axle load capacity has been increased. Heavier rear springs and axles, a larger hub bearing and six ply tires are standard equipment.

The new wagon is powered by a compact 54.8 hp, four-cylinder engine; it has a wheel base of 98″, and an overall length of 167.5″. Despite its relatively small size, the Victor will seat six persons comfortably. When the second seat is folded down the wagon provides a flat cargo space over five feet long, four feet wide and nearly three feet high.

Calendar of Automotive Events

1958

April 23-25—1958 Spring Booth Conference of Automotive Wholesalers and Manufacturers Representatives, Bon Air Hotel, Augusta, Ga.

May 11-14—Automotive Engine Rebuilders Association Convention, Sheraton-Park Hotel, Washington, D. C.

May 26-27—NAPA National Business Conference, Sheraton Park Hotel, Washington, D. C.

May 29-31—Independent Garage Owners of California, Inc., Annual Convention, Hacienda Motel, Fresno, Calif.

June 8-13—SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

June 25-29—IGO-America 1958 Convention, Statler Hotel, Los Angeles, Calif.

August 27-30—Automotive Parts Rebuilders Assn., National Convention and Trade Show, Conrad Hilton Hotel, Chicago, Ill.

Dec. 12-16—Automotive Warehouse Distributors Assn., Inc., National Convention, Muehlebach Hotel, Kansas City, Mo.

1959

Jan. 17-25—Chicago Automobile Show, International Amphitheatre, Chicago, Ill.

More than one in every six families owning automobiles has two or more cars—only ten years ago, in 1948, the ratio was less than one in 20.

Rajah

HAND CRIMPING TOOL

HAND CRIMPING TOOL
Order from Your Jobber or Direct from Us. Send for Circulars and Prices

It Cuts
And Strips
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"$3,969 IN 1 MONTH Repairing Radiators!"

"My Inland equipment and the wonderful job it does has attracted nearly a $4,000-a-month volume!" — Hayland's Auto Paint & Body Works, Baton Rouge, La.

"We are going at the rate of $16,000 a year!"—McRill Auto Service, Twin Falls, Idaho. "$13,904 in 9½ mos.!"—McCain-Richards, Monroe, La. Many do as well or better. Why don't YOU get into this Big Income business?

20,000,000 Radiators Need Servicing Yearly! And with today's engine power increased, and the cooling capacity decreased, radiators will require more service than ever before! Here's a business with a growing future!

Inland, the industry's leader, offers equipment, training, Pays-For-Itself purchase plan—advertises nationally to attract radiator servicing business to Inland-equipped shops. Mail coupon!

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The New

K. O. Lee Valve Guide Reaming Sets

Designed to service late model engines which have valve guides cast as part of the cylinder head. In this new type head, it is the valve which has to be replaced. This is accomplished by reaming out the valve guide for oversize stem valves. Most of the engine and valve manufacturers now offer at least three sizes of oversize valves.

The Lee Reamer Guide provides a true alignment with original guide bore using Lee Self-expanding pilots. The reamer is held rigid with reaming bushing during reaming operation. Simple to operate and extremely accurate.

Special sets available to service Ford, Mercury, Lincoln, Chevrolet, Plymouth, Dodge, DeSoto, Chrysler.

R55 Reseater Power Drive adapts to these valve guide reaming sets.

Clip ad to your letterhead and send for Literature.

K. O. Lee Company, Aberdeen, S. D.

Ring Jobs . . . *(Continued from page 22)*

and check the rings in them for gap clearance, or he didn't mike the cylinders in enough locations. For one of the two reasons, the rings were forced into too small an area, the ring ends butted together and broke or twisted the ring. We have to face it—some lousy so-and-so may have bored one hole oversize and that was the one we measured, "trusting" that the others were the same!

You simply can't trust pistons either—they may wear cylinders unevenly, so a fit for one is a miss for the other. There have been rumors that an oversize ring or two have been found in sets too, but true or not, if you always suspect it, you are more likely to check them in each bore—and that ain't bad. Invert the piston and slide one compression ring down each cylinder bore to the unworn portion below ring travel. Remove piston and measure ring gap. Check this end clearance against specs and with ring end clearance in other cylinders to be safe.

RING COMPRESSOR IS A MUST

We mentioned the comebacks from distorted rings caused by twisting them into their grooves during assembly. Broken and distorted rings have also been found in jobs where the mechanic failed to use a ring compressor when installing the piston and ring assembly in the cylinder, and thus damaged them in working them into the bore. Always be sure you have a ring compressing device for the job at hand, for the time they save and the damage they avoid. When lightly tapping the piston into the cylinder with a hammer handle, keep alert for a solid thump that indicates a ring isn't entering the cylinder; and then remove piston to ascertain why the resistance, before a ring is damaged.

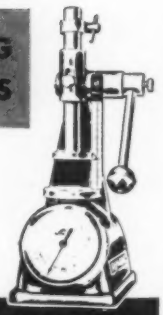
While it is second nature for most mechanics to apply oil to newly assembled parts, there have been indications on some comebacks that rings and pistons were assembled into the cylinder without the necessary preliminary dousing with SAE 30 oil to provide lubrication and sealing when the engine is first started. The dry rings delay the start because of compression leakage; and thus cause the parts to work together without lubricant longer, until damage occurs.

The four classic noisemakers that mechanics sometimes built into their ring jobs, often resulting in a comeback before the car ever left the shop, now rarely appear. Each mechanic has usually learned to remove the ridge at the top of the cylinder before the top ring and land start beating it, with resulting noise and damage to the parts. The oversight in removing the ridge was more pronounced in jobs where the pistons could be removed from below and the old rings therefore didn't hang up on the ridge as a reminder. Cutting the ridge is now the first step taken before removing the pistons.

Experience taught us that a raise in compression after a ring job would make piston pins and loose pistons rap and slap, which was not noticeable before the rings were replaced. Expanding the piston also assures the rings of a better aligned foundation for cylinder wall contact; so is doubly important. One or more bent connecting rods can set up an awful clatter—and likewise hold piston and rings out of alignment.

At this point it might appear that most all the reported mistakes and oversights leading to ring-job comebacks are centered about the ring-on-piston operations, with only slight attention to the cylinder bore, its taper, glaze, or rebore problems, and even less comment on properly installed rings that failed to wear in, and whether such problems are caused by lubricant type or wall surface finish. Of course this isn't true, but cylinder finishing and measuring processes are another story.

RIMAC SPRING TESTERS



In service and overhaul operations of car, truck, bus and farm machinery, proper tension of springs — valve or clutch — is vital! With a Rimac Spring Tester the mechanic sees both length and tension at a glance. Tests springs up to 2" diam., 4½" length — capacity 0.250 lb.

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HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

A New Mexico Sheriff, seeking re-election, was out politickin' around an Indian Reservation. He came upon a group of Squaws and proceeded to solicit their votes.

"Now, if you Squaws will vote for me," he said, "I'll guarantee you full benefit of the Social Security."

An interested Squaw asked what the Social Security was.

In explaining, the Sheriff replied, "Well, that's a plan whereby you'll get about 80 bucks a month when you're sixty years old."

"Ugh"! muttered the Squaw, "when sixty years old, one buck a month do fine."

★ ★ ★

Preacher (meeting a neighbor bringing home a load of hay): "Wouldn't it be better if you attended services this morning instead of working this way?"

Farmer: "To tell the truth I ain't figured out yet whether it would be best to sit on a load of hay and think of religion or to sit in church and think of hay."

★ ★ ★

A friend of ours recently bought a foreign-made automobile and after careful computation over a month came to the conclusion that he was not getting the phenomenally high mileage so often credited to such cars. So he took it to a local mechanic who, after checking it thoroughly, pronounced it in perfect condition. "But isn't there something I can do to increase its mileage?" he asked.

"You can do the same as most foreign-car owners do," replied the mechanic. "Lie about it."

★ ★ ★

Susan tried to engage the services of a lawyer for a seduction suit against her employer. The attorney told her that she had insufficient facts to support the action. She left dejectedly, but returned triumphant the following morning, to report, "He did it again last night."

A small girl was taken to church for the first time. When everyone knelt down, she whispered: "What are they going to do?"

"They are going to say their prayers," whispered back her mother.

The child looked up in amazement; then, in a loud voice, she exclaimed: "What, with all their clothes on?"

★ ★ ★

The meanest man in the world is the warden who put a tack in the electric chair.

★ ★ ★

Census Taker (to woman at door): "How many in your family?"

Woman: "Five. Me, the old man, the kid, the cow and the cat."

Census Taker: "And the politics of your family?"

Woman: "Mixed. I'm a Republican, the old man's a Democrat, the kid's wet, the cow's dry and the cat's on the fence."

"Boss in?"

A small wholesaler collected many past-due accounts through the use of the following note on his statements:

"If you will refer to the date of our original invoice, you will note that we have done more for you than your own mother; we have carried you for 14 months!"

★ ★ ★

A Red professor was indoctrinating his students in Marxian methods of thinking.

"In my right hand," he began, "I have a flea. I now order the flea to jump over to my left hand. As you can see, the flea obeys me.

"Now," he continued, "I remove the legs of the flea and order it to jump again. You will note that the flea does not jump—which proves scientifically, gentlemen, that a flea whose legs are removed becomes deaf."

★ ★ ★

A visitor at the Capitol was accompanied by his small son. The little boy watched from the gallery when the House came to order.

"Why did the minister pray for all those men, Pop?"

"He didn't. He looked them over and then prayed for the country."

★ ★ ★

She had paper and pencil ready as the operator looked up the number. "Madam," the operator said, "the number is CApital 5-1531."

The woman paused, then asked, "How do you make a capital 5?"

★ ★ ★

A good speaker, someone once said, breaks his speech down into three parts:

First he tells 'em.

Second, he tells 'em that he told 'em.

Third, he tells 'em why he told 'em what he told 'em.

Then he stops.

★ ★ ★

To those who talk and talk
This adage doth appeal;
The steam that blows the whistle
Will never turn a wheel.

★ ★ ★

Clem: "Man, I've got the craziest girl. Last night while we were sitting on the sofa she turned out the lights, snuggled up close to me and said, 'Clem darlin', let's play Post Office.'"

Lem: "Why they's nuthin' silly about that. What happened?"

Clem: "We didn't get to play. She was gone when I got back from the drugstore with the stamps."

★ ★ ★

The man in the big Cadillac had tried for twenty minutes to outdistance the small foreign car that had been traveling behind him.

As he hit 90, the small car drew alongside. "I say," yelled the driver, "Do you know anything about this make car, I can't get her out of low gear!"

*CIRCUMFERENTIAL EXPANSION ACTION GIVES YOU:
Immediate, No-Drag Sealing—stops oil pumping, Chrome rails increase ring life.
Sure-Fire Oil Control—even under high vacuum deceleration conditions. Positively seals top and bottom of ring lands against "oil creep" on all piston strokes.
Automatic Adjustment to Wear—adds new car miles to rings, cylinders, pistons.
CHROME C-9 OIL RINGS FOR NEWER ENGINES
RAMCO
10 up
PISTON RINGS
CHROME SPIRO-SEAL OIL RINGS FOR OLDER ENGINES

SMART MOTORISTS WANT RAMCO RE-POWERING

to positively stop bad blow-by odors

Of course, they don't *know* they want RAMCO rings—might not even know the name.

But *you* will—because smart engine men know how to insure positive oil control and end bad blow-by odors for good.

It's done with RAMCO Chrome Piston Ring Sets, of course. In every 10-Up Set, you get the right chrome oil ring with *circumferential expansion action** in combination with correctly engineered compression rings. For the newer type engines you get RAMCO 10-Up Sets with C-9—for the older engines RAMCO 10-Up Sets with Spiro-Seal rings. Both make you Double Sure to get *circumferential expansion action**.

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DOUBLE SURE RAMCO 10 up SETS

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loafing on the job

This ignition coil looks exactly the same as any other of its type — on the outside. But, internally, it's defective and not delivering the performance it should. The Sun Scope Motor Tester has caught it loafing on the job — detected it instantly, clearly and accurately in just a matter of seconds!

Component troubles such as this are easily located and pinpointed with the Sun Scope Motor Tester. It saves mechanic's valuable time — insures better customer satisfaction with tune-up and service jobs.

You should investigate the Sun Scope Motor Tester for your shop. Or — if you already own a Sun Master Motor Tester — find out how EASY and ECONOMICAL it is to convert to a Sun Scope Motor Tester.

Your local Sun Representative will be glad to demonstrate and explain all the details. Call him TODAY.

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